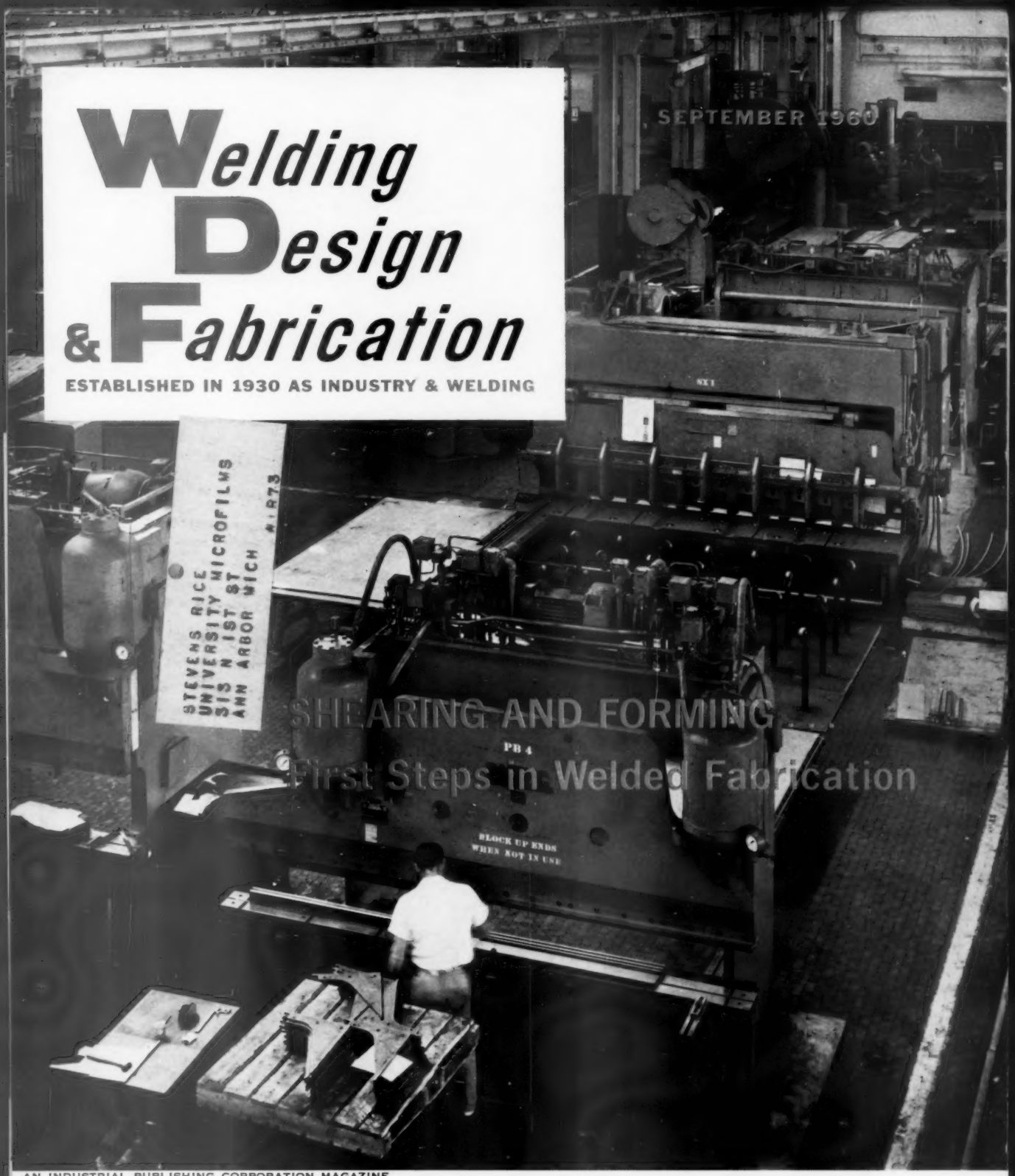

Welding Design & Fabrication

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SHEARING AND FORMING

First Steps in Welded Fabrication

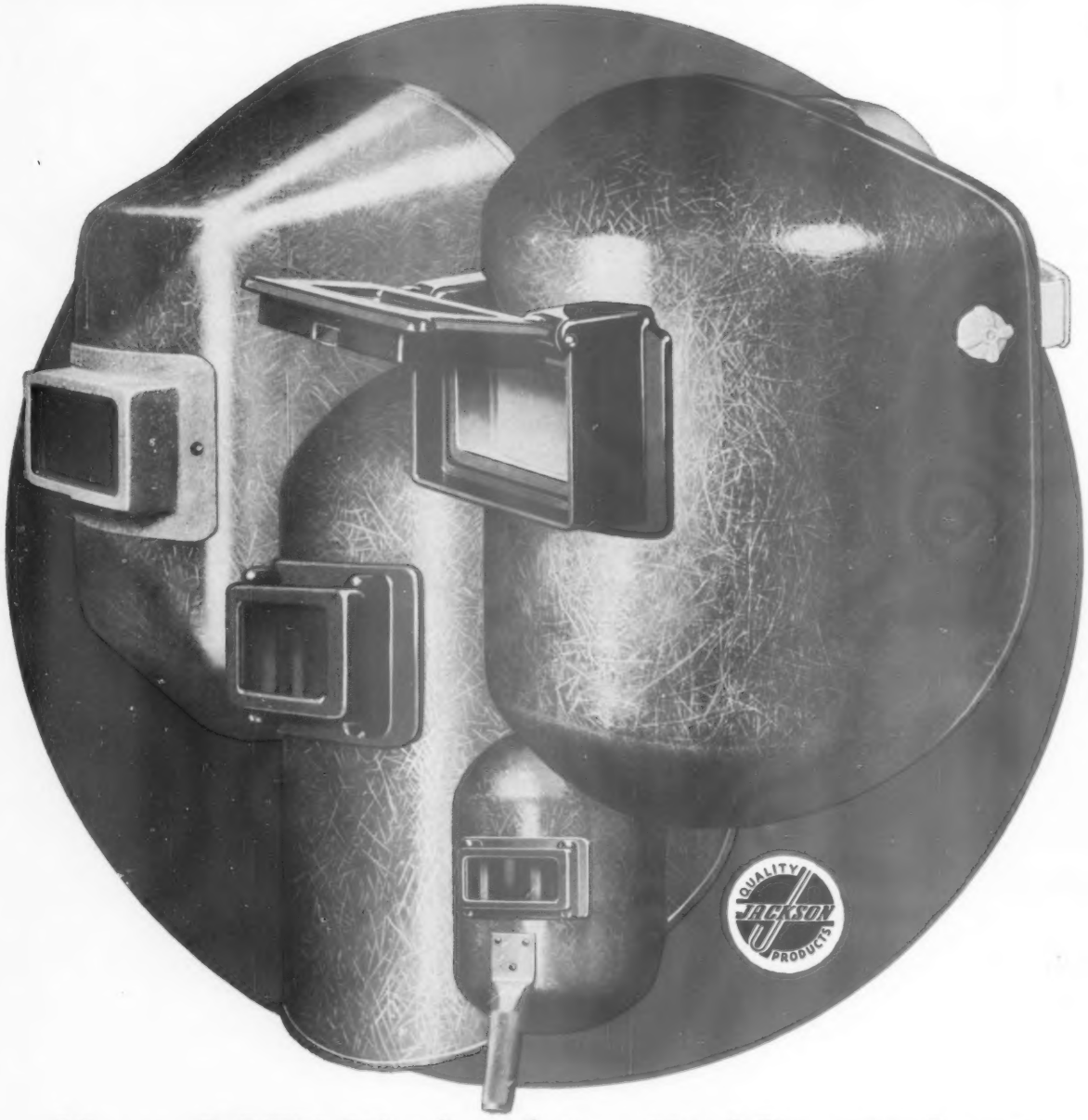
AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

ALSO IN THIS ISSUE

WILL WELDED ALUMINUM REPLACE STEEL IN RAILROAD CARS?

FABRICATING AND WELDING THE TITAN MISSILE

WELDED SKYSCRAPER HAS SPECIAL COLUMNS AND GIRDERS



Now, BOTH Kinds of Arc Welding Helmets

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COMPARE the **extra features** at no extra cost.

FEATURES	HOBART	Other make welders #1	#2	#3	#4
Interior protected from valve leak wetting	YES	NO	NO	NO	NO
Water strainer included	STD.	NO	NO	NO	NO
Type stabilizer (standard)	BALLAST	BALLAST	NONE	BATTERY	NONE
duty cycle, %, on AC Tig welding	60	60	60	35-50*	60
Separate "tig torch" terminal	STD.	NO	NO	NO	NO
Pneumatic timers	STD.	NO	NO	NO	NO
Current overload protection	STD.	NO	NO	STD.	STD.
Gas & water pilot light	STD.	NO	NO	NO	NO
Remote hand rheostat	STD.	EXTRA	EXTRA	STD.	EXTRA

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reader's guide to

for September, 1960

COVER: A manufacturer of heavy equipment uses shearing and forming as first steps to efficient welded fabrication. They use both mechanical and hydraulic press brakes, ranging from 200- to 500-tons. and mechanical and hydraulic shears, ranging from ½- to 1-inch capacity. This equipment is made by Cincinnati Shaper Co., Cleveland Crane & Engineering Co., and Pacific Industrial Mfg. Co.

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39 AUTOMATIC BRAZING FOR UNIFORMITY AND PRODUCTION
In the competitive utensil market, price and quality are important. Automatic brazing lowers the first, raises the second.

42 TECHNIQUES FOR FABRICATING AND WELDING THE TITAN MISSILE
New forms and applications of conventional processes are used. These include automatic welding in a variety of special fixtures, tape-controlled and chemical milling, and stretch forming.

44 HOW TO WELD BORON-STAINLESS WITHOUT CRACKING OR DISTORTION
Allis-Chalmers checked out three ways to fabricate atomic power plant control rods from brittle, neutron-absorbing, boron-bearing stainless. Manual welding in a rigid fixture won out.

46 DESIGN SPECIAL COLUMNS AND GIRDERS FOR WELDED SKYSCRAPER
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This materials handling equipment manufacturer made a thorough investigation before switching to low pressure natural gas for automatic flame cutting.

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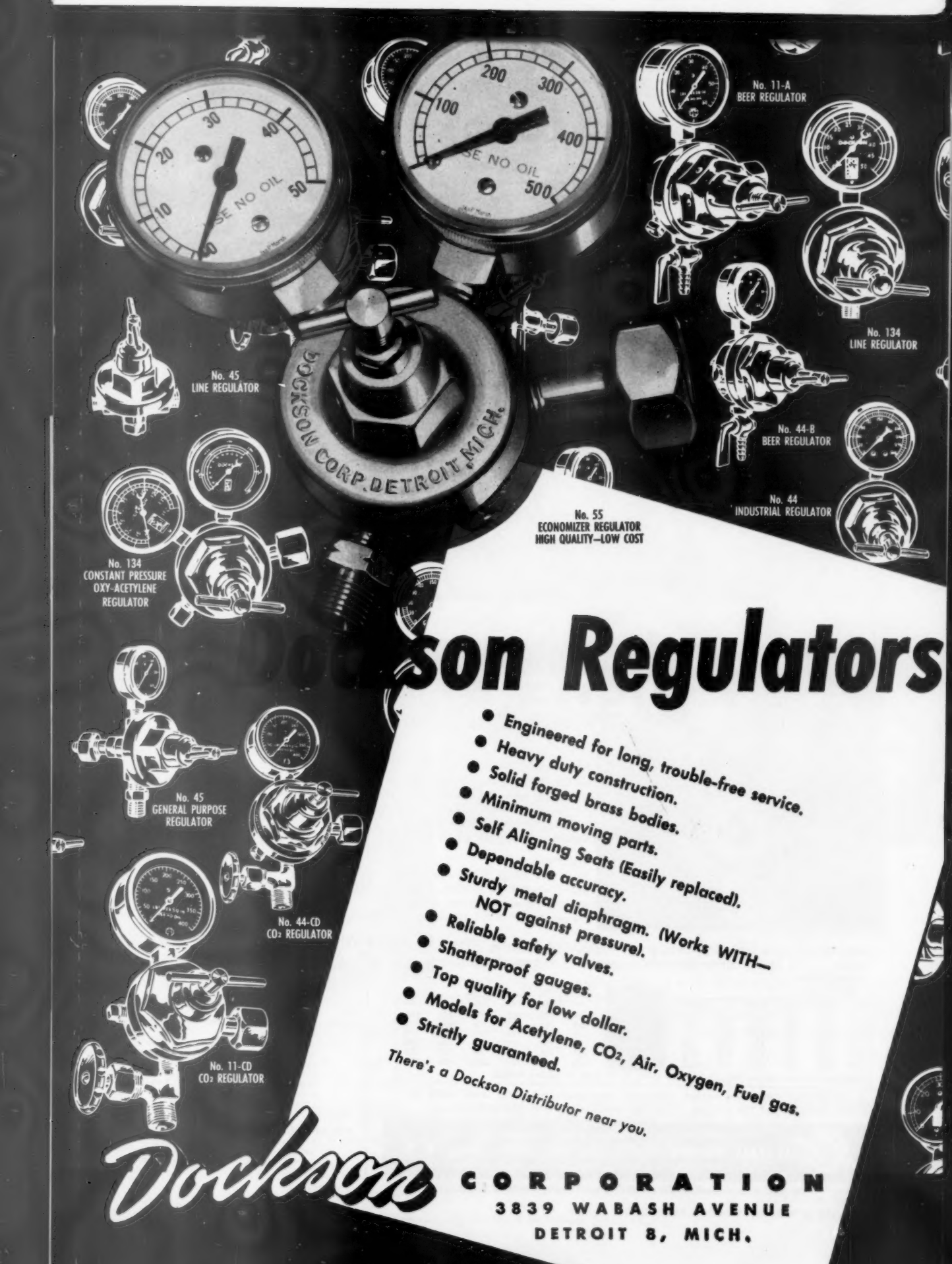

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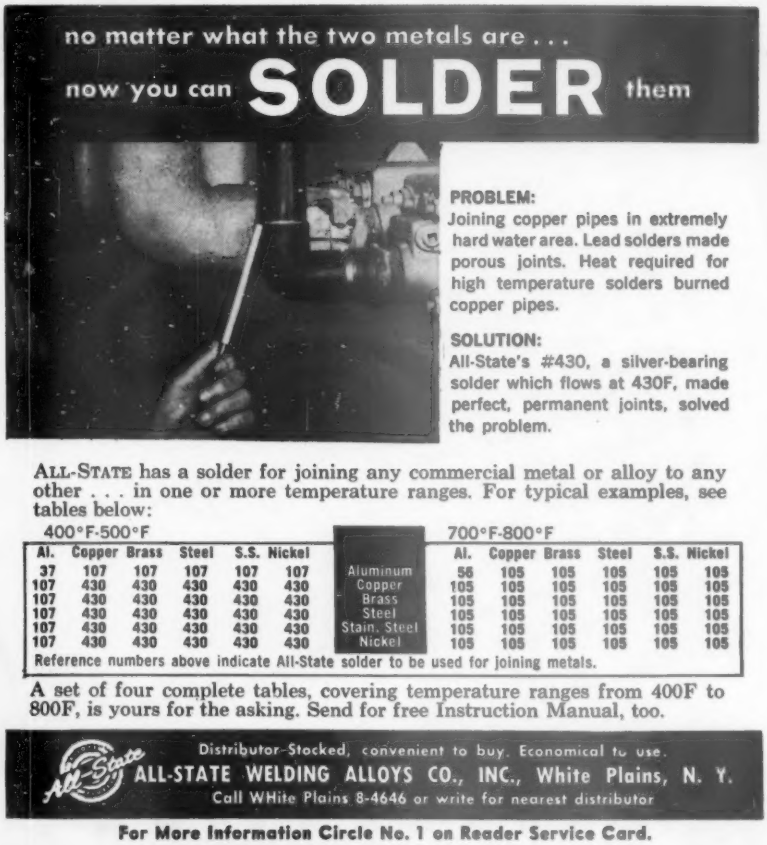
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Copper 107 430 430 430 430 430
Brass 107 430 430 430 430 430
Steel 107 430 430 430 430 430
Stain. Steel 107 430 430 430 430 430
Nickel 107 430 430 430 430 430
Al. Copper Brass Steel S.S. Nickel
Aluminum 56 105 105 105 105 105
Copper 105 105 105 105 105 105
Brass 105 105 105 105 105 105
Steel 105 105 105 105 105 105
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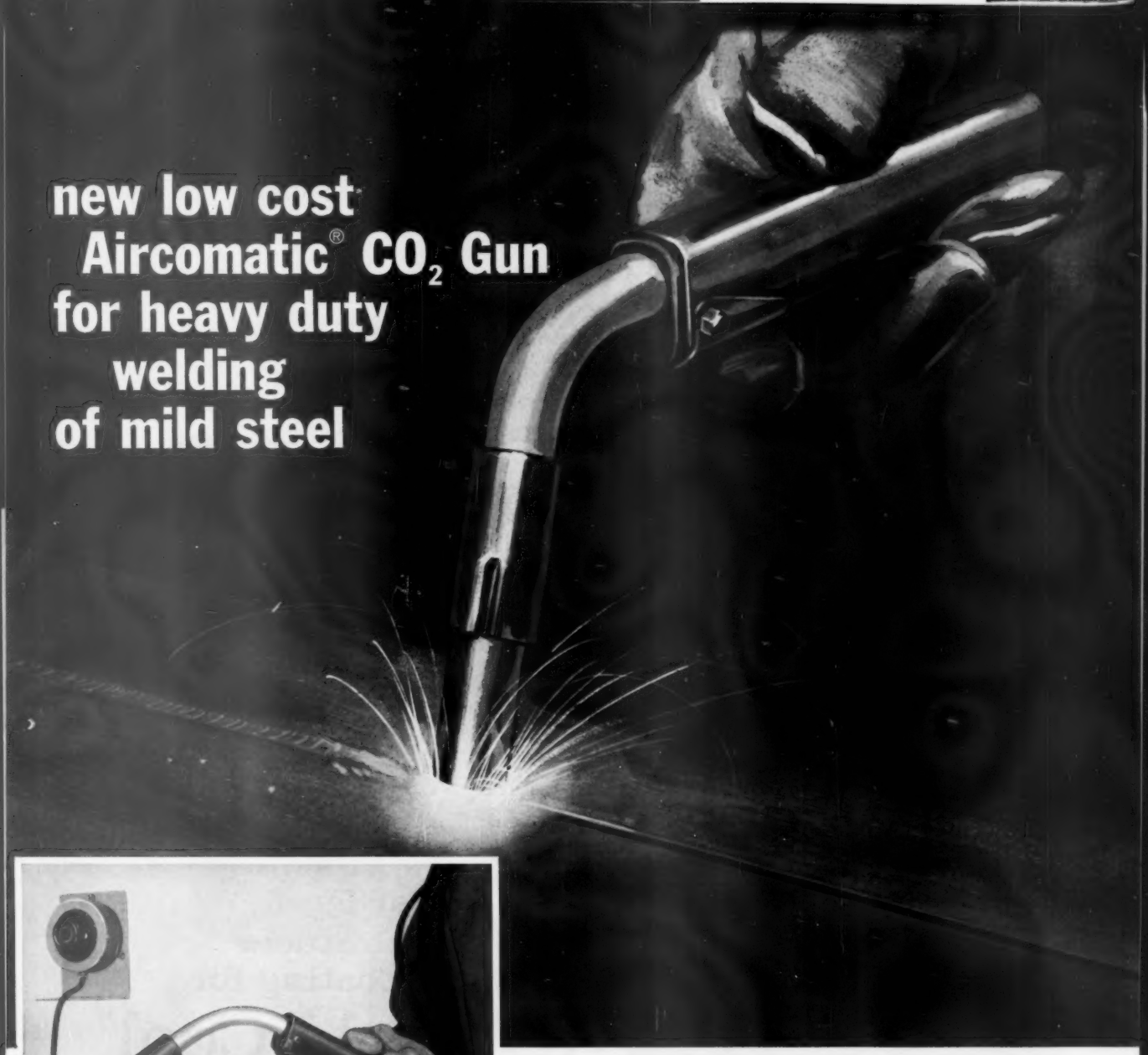

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Quick Facts

- Model 9706-W has white exterior, curved chin aluminum glass holder, lift front. Model 9702-W same except has stationary front.
- Inside coating has non-reflective dull black surface.
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- Helmets are flame resistant.
- Headgear locks securely when set to desired head size.
- Adequate ventilation.
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The weldor pictured above is TIG welding a 9/16-inch Grade "A" Nickel bottom shell to a 5/32-inch Type 304 (18/8) stainless steel outer shell to complete a 600-gallon steam-jacketed kettle.

When the picture was taken, the fabricator, J. C. Pardo & Son of Schenectady, N. Y. was also completing a similar kettle formed of Nickel and mild steel.

In *both* jobs, joining procedures and materials were *exactly* the same . . . initial tacking with Inco-Weld* "A" Electrode (that's the one with the green flux coating) . . . finish welding with cut lengths of Inco-Weld "A" filler wire (inert gas). In *both* jobs, the welds are sound, strong and as corrosion-resisting as the most corrosion-resisting parent metal.

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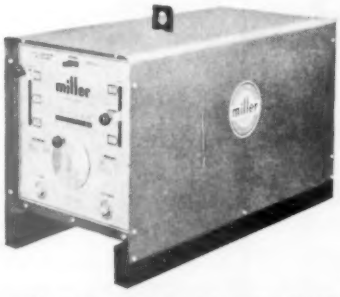

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M-295 — new wide range a-c welder of horizontal design. Two welding ranges of 25-115 amperes and 80-295 amperes which handle all metals from light gauge to heavy plate.

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LIBRARY

of welding

Welding Techniques

"Welding Skills and Practices," American Technical Society, 848 East 58th Street, Chicago 37, Illinois, 279 pages, $4.95.

This book presents practical instruction in developing specific welding skills and presents a general overall view of the various processes.

It is divided into two parts—one on oxy-acetylene welding, the other on electric arc welding. Each section covers current welding techniques, with numerous illustrations added.

Metallizing Shafts

"Revision of Recommended Practices for Metallizing Shafts or Similar Objects" by the American Welding Society, 32 pages, Dept. T, 33 West 39th Street, New York 18, N. Y. $1.00.

This revision of recommended practices has been published by AWS. This booklet is illustrated with diagrams, line drawings, and halftones. It contains many useful tables.

A new section on surface preparation has been introduced. The methods of roughening have been divided into three groups. Recommendations are given as to when to use each.

Most of the material has been rewritten to bring it up-to-date. It has been divided into four sections: general, surface preparations, spraying, and finishing.

Brittle Fracture

"Evaluation of Weld-Joint Flaws As Initiating Points of Brittle Fracture" by R. P. Sopher, A. L. Lowe, Jr., and P. J. Rieppel, Battelle Memorial Institute for Bureau of Ships, U. S. Navy, Aug., 1958 55 pp. Order PB 161323 from OTS, U. S. Department of Commerce, Washington 25, D. C., $1.50.

The objective of this Navy research project was to learn how brittle fracture begins. Investigation, confined to flaws shorter than four inches, showed that some fractures resulted from an applied stress of less than 6,000 psi.

Tests showed that flaws of any size or shape, especially cracks or lack of fusion in weld joints, can be considered danger points, if the steel is near nil-ductility temperature.

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WELDING MANAGEMENT

watches these developments

A LONG RANGE PROGRAM to equip all its aluminum foil manufacturing facilities with ultrasonic seam welding equipment has been announced by Reynolds Metals Company. "The equipment (two units are now in use) is installed on foil processing machinery to splice breaks," explains Frank L. Eichner, general manufacturing manager of the firm's foil division. "The ultrasonic equipment improves the quality of Reynolds foil and saves valuable production time," says Mr. Eichner. "With this equipment, finished foil can be laminated and printed without interruption."

THE FIRST HALF STEEL OUTPUT was the third highest on record despite a gradual decline during April, May, and June. Here's what American Iron and Steel Institute tonnage figures show:

PERIOD	1960	1959
FIRST HALF	60,743,222	64,278,203
SECOND QUARTER	26,002,329	33,800,000*
JUNE	7,394,000	8,830,472

*Approximate

HOW MODERN PSYCHOLOGY can sharpen an executive's ability to recognize and develop sales service skills in the men he supervises was taught in a 4-day clinic at Stevens Institute of Technology, Philadelphia. Attending were 23 field supervisors and regional sales managers for Eutectic Welding Alloys Corp., Flushing, N. Y. A similar clinic is being set-up for next year.

A JOINT STATEMENT by McKay Machine Co., Youngstown, Ohio, and Federal Machine and Welder Co., Warren, Ohio, announces that McKay proposes to offer to Federal stockholders an exchange of one share of McKay common stock for 19 shares of Federal common stock.

The companies have a combined work force of more than 1100 employees and about 300,000 square feet of manufacturing area. McKay designs and builds coil handling and leveling equipment, forming machines, press feeding equipment, high-speed equipment for pipe and tube mills, and a new shear line for cutting coils of steel to length. Federal designs and builds resistance welders, Warco presses and special metalworking equipment.

Both firms have affiliated companies.

RED-WHITE-AND-BLUE SHIPPING TAGS bearing a prominent United States shield and a "Made in U.S.A." inscription are being used on welding fittings made by Chemtron's Tube Turns Division. The company is taking the step to help distributors and customers guard against the purchase of so-called "question mark" merchandise.

CURRENT WELDING TRENDS will be presented in one of seven courses in working of metals scheduled for this Fall by the Evening Division of Akron University, Akron, Ohio. As is the case in many universities, the welding course will be taught by an expert from welding industry. In this case, the teacher will be Anthony R. Mellini, welding engineer at Babcock & Wilcox Co., Barberton, Ohio. Mr. Mellini was formerly associate editor of WELDING DESIGN & FABRICATION and is currently a member of WD&F's Editorial Advisory Board.

BETATRONS NOW CAN BE LEASED from Allis-Chalmers Mfg. Company, Milwaukee. First lease for a 25-million volt betatron has been made by R. K. Loeffler, M.D., for use in Massilon, Ohio. In addition to therapeutic radiation treatments during the day, the betatron will be used for nondestructive testing of weldments and castings. The high voltage of the units speeds X-raying.

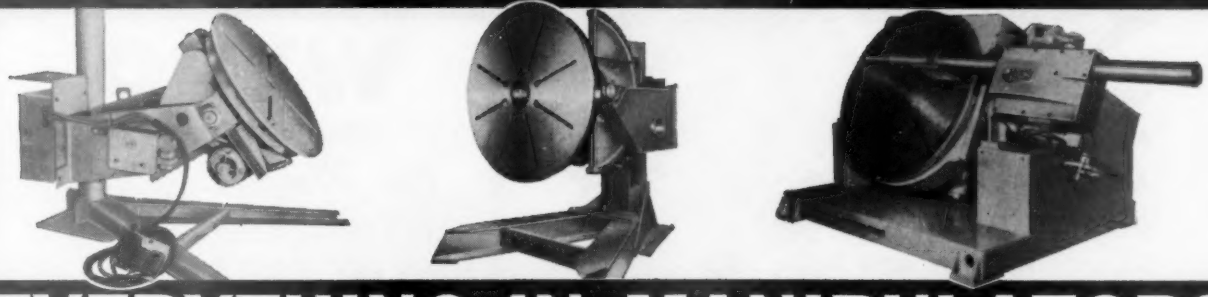
A 20TH ANNIVERSARY was celebrated this year by Alloy Rods Company, York, Penna. E. J. Brady, president and founder, displays one of the two hydraulic presses which extruded the company's first Arcaloy stainless steel electrodes. This press and its working mate produced more than 14,000,000 pounds of stainless electrodes in 3½ years.

Circle No. 61 on Reader Service Card. →

RANSOME HAS EVERYTHING!

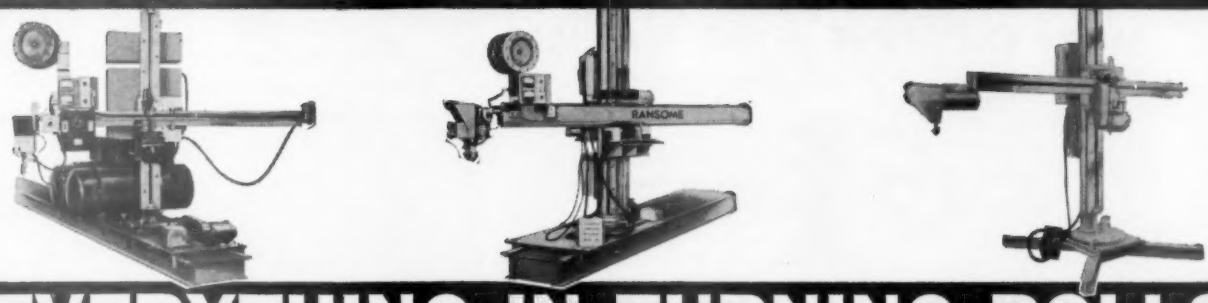
EVERYTHING IN POSITIONING

Ransome—fullest, most complete line in Automation Welding



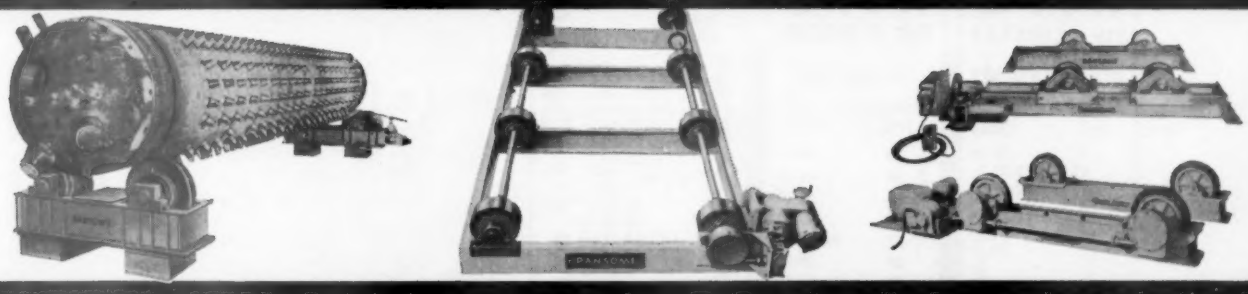
EVERYTHING IN MANIPULATORS

Ransome imagin-eering can help you do the job more efficiently at less cost



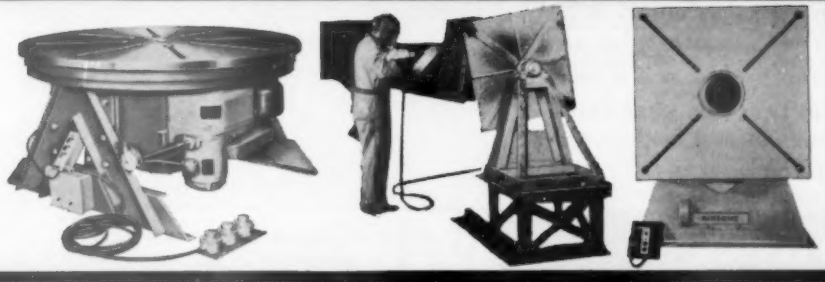
EVERYTHING IN TURNING ROLLS

You can expect the new, the different, the better from Ransome



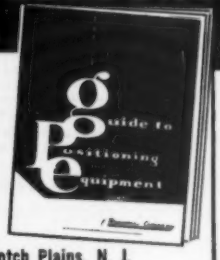
EVERYTHING IN TURNTABLES & HEAD & TAILSTOCKS

Ransome off-the-shelf standard equipment and job-fitted specials



THIS VALUABLE GUIDE IS YOURS

MAIL COUPON NOW



Ransome Company, Scotch Plains, N. J.

☐ Send *Free Guide* to positioning equipment.

☐ Have your sales engineer call.

Name.....

Company.....

Address.....

City, Zone, State.....

Ransome Company

• • • MACHINE TOOLS FOR WELDING • • •

Division of Big Three Welding Equipment Co.

Scotch Plains, New Jersey

RANSOME . . . THE PIONEER IN POSITIONING FOR WELDING

NEW! WYPO FILE FREE!

NEW POLISHED ALUMINUM CASE, DESIGNED TO SERVE AS HANDLE FOR THE NEW FILE

Let Your Local Welding Supply Dealer Explain WHY
'YOU GET SO MUCH MORE'
with

WYPO

Wipes and Polishes
the World's Finest
CUTTING AND WELDING TIP CLEANERS

NEW, SPECIALLY DESIGNED WYPO POLISHING FILE INCLUDED IN EACH SET FREE

MORE EXCLUSIVE WYPO FEATURES

This cross section view of WYPO Cleaning Surfaces shows these exclusive features:

Rounded cleaning surfaces that won't jam or cut.

Straight sided valleys insure thorough cleaning by removing all waste.

MADE OF STAINLESS STEEL

Now Available in Three Convenient Sets

WYPO TIP CLEANERS
STANDARD SET

CLEANER NO.	FOR DRILL
7	75-74
8	73-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49

S. S. WYPO FILE
MADE IN U.S.A
PAT. NOS. 2429581, 2473758
IN CANADA 1948

STANDARD SET OF (12)
Cleans (27) Drill Sizes
Nos. 75 to 49 Incl.

WYPO TIP CLEANERS
JUMBO SET

CLEANER NO.	FOR DRILL
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
45	30

S. S. WYPO FILE
MADE IN U.S.A
PAT. NOS. 2429581, 2473758
IN CANADA 1948

JUMBO SET OF (9)
Cleans (19) Drill Sizes
Nos. 48 to 30 Incl.

MASTER SET
WYPO TIP CLEANERS

CLEANER NO.	FOR DRILL
7	75-74
8	73-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
45	30

S. S. WYPO FILE
MADE IN U.S.A

PAT. NOS. 2429581, 2473758
IN CANADA 1948

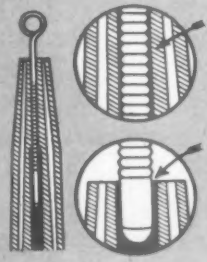
MASTER SET OF (21)
Cleans (46) Drill Sizes
Nos. 75 to 30 Incl.

REPLACEMENT CLEANERS AND FILES ARE AVAILABLE
Cleaning Range — Cleaner No. and Drill Nos. stamped on back of each case.

WYPO GIVES YOU MORE
SOLD BY LEADING WELDING SUPPLY DEALERS

Doubles The Life of Your Welding and Cutting Tips

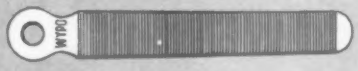
The exclusive circle design found only in WYPO Cutting and Welding Tip Cleaners provides as many as 60 more cleaning edges per inch of cleaner. .



These rounded outer edges of cleaning ridges clean and polish tip orifice without scratching or cutting.

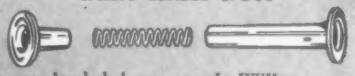
This smooth pilot guides WYPO Tip Cleaner into tip Will not enlarge or damage tip port.

STAINLESS STEEL POLISHING FILE



Specially designed WYPO File furnished free in each set

SPRING LOADED SPOOL



Spring loaded brass spool. Will not rust. Holds cleaners securely in case.

DOUBLE WOUND EYES

Insures longer life for small sizes of WYPO Tip Cleaners. Will not pull out of case.

Packed in a handy metal container

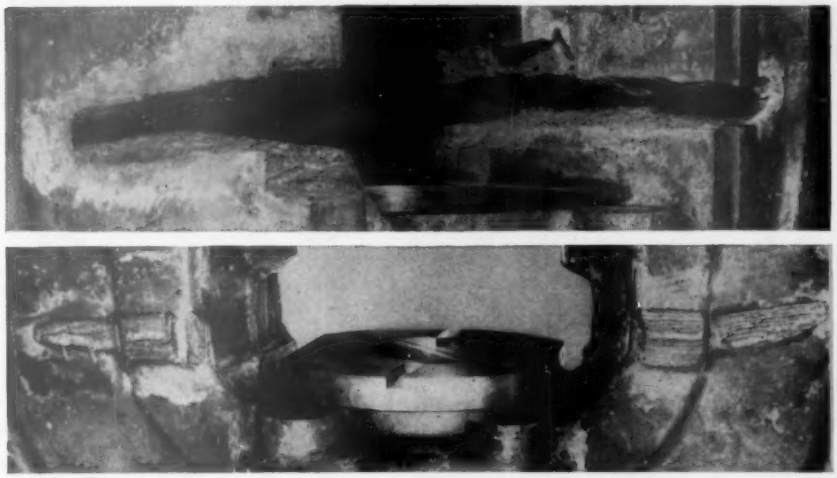
MAITLEN AND BENSON, INC.
1395 Obispo St., Long Beach 4, Calif.

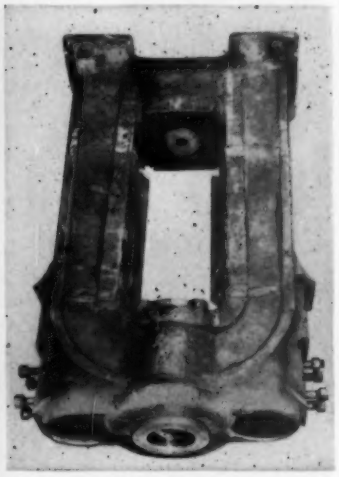
WYPO TIP CLEANERS ARE RECOMMENDED AND DISTRIBUTED BY ALL LEADING MANUFACTURERS OF WELDING EQUIPMENT.

For More Information Circle No. 56 on Reader Service Card.

201 WAYS TO BETTER WELDS: HERE'S ONE...

Huge swaging press went out of action when deep cracks opened in its 25-ton cast steel frame. Weld repair posed problems: heat danger to base metal; high strength demands.





Only EUTECTIC had the answer. Cracks were veed out with ChamferTrode®, then EutecTrode® 680 was deposited at high speed with low amperage. Frame never got hot. Bond gave tensiles up to 120,000 psi, great shock resistance. Press back in production . . . downtime and money saved.

AND 200 MORE . . . The above is but one example. Eutectic's research has resulted in over 200 other problem-solving "Low Temperature Welding Alloys."® Repeatedly, our exclusive Low Heat Input Process results in better, safer, permanent weld repairs. To get the most from your maintenance welding, get the advice of your local Technical Representative; he's ready to help any time, anywhere.

Please send:

☐ New MAINTENANCE WELDING DATA BOOK

☐ Complete literature on EutecTrode 680

Name ..... My Title .....

Company .....

Address .....

City ..... Zone .... State .....

®Reg. T.M. Eutectic Welding Alloys Corp.

40-40 172nd Street, Flushing 58, New York

EUTECTIC WELDING ALLOYS CORPORATION

Originator of the Low Heat Input Process . . . The ONLY welding alloy manufacturer in the world capable of producing welding rods and electrodes from virgin metals to finished products in ANY metal.

For More Information Circle No. 22 on Reader Service Card.

NOW, A MANGANESE STEEL ELECTRODE
with High Build-up, Low-spatter, Easy Slag Removal

A special new Amsco rod, Nicro-Mang, for both joining and buildup of manganese steel

Out of Amsco® metallurgical research has come a new welding rod that gives you high weld strength without cracking on Austenitic manganese steel. A rod that lets you lay down a bead without slag popping, and slag removal is easy.

To lick the cracking problem, it took a special alloy of chromium and nickel, plus a unique coating for Nicro-Mang.

Write for Nicro-Mang bulletin, or see your local Amsco distributor.

Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Illinois

For More Information Circle No. 3 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

APPOINTMENTS:

RYAN

BELLAMY

James F. Ryan is in charge of welding and brazing sales for Whitehead Metals, Inc. Mr. Ryan succeeds **John T. Stewart** who will head new product development for this affiliate of International Nickel Co., Inc.

Milwaukee Electric Tool Corp., Milwaukee, has appointed **Robert Bellamy** district sales representative for the state of Indiana, excluding Lake County.

Norton Company, Worcester, Mass., has appointed three field engineers. They are: **John M. Nelson,** Chicago; **J. Robert Lowry,** Atlanta; **Robert D. Stubblebine,** Detroit.

V. E. Stucky has been appointed to the Kansas City, Mo., sales staff of A. O. Smith Corporation's Welding Products Division.

Named technical director at Colonial Iron Works Co., Cleveland, Ohio, is **Dr. A. J. Teller,** an authority in the field of mass transfer.

RETIREMENTS:

Andrew B. Holmstrom has retired as vice president of Norton Company, Worcester, Mass. He started with Norton 41 years ago.

BIRTHS:

The birth of a son, John Frederico, has been announced by **Rene and Dedette Wasserman.** Mr. Wasserman is president of Eutectic Welding Alloys Corp., Flushing, New York.

continued on page 20

Nearly everyone in metals will be in Philadelphia October 17

"Our materials engineering responsibility extends from A (Aluminum) to Z (Zirconium). We plan to take to Philadelphia in October a series of questions concerning specific problems that need resolution at that time. The people that have the answers to these problems will be there as vendors, authors, or co-workers."

G. F. Kappelt
Chief Metallurgist
BELL AIRCRAFT CORP.

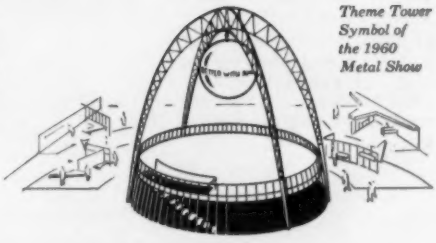
"ASM brings together in one place and at one time the year's most important developments in the technical and practical aspects of the metals industry. Never have I left a show without several ideas for applications of materials, equipment or processes in my engineering work. The 1960 Metal Show promises me more 'take home' than ever."

Raymond J. Hibbeln,
Dept. Chief, Product & Development Engineering
WESTERN ELECTRIC COMPANY

That's how important the 1960 Philadelphia Metal Show will be . . . not only to the recognized leaders but to those on the way up in metals and materials technology. Everyone will look to this event as a vital concentration of the latest thought and achievement. Your participation is a must for keeping technologically up to date, and the Metal Show does meet this need. This year a new emphasis on metals and materials, processes and techniques will be presented by 300 exhibits and 250 technical papers. PLAN NOW TO ATTEND!

"The annual Metal Show presents a consolidated review of 'What's New' in our industry, particularly in manufacturing development. There are very few events where so much can be seen and heard in so little actual time. This is why I plan to be in Philadelphia October 17."

H. J. Gilliland, Supervisor
Metallurgical Engineering
Manufacturing Development
GENERAL MOTORS CORP.



Theme Tower Symbol of the 1960 Metal Show

NATIONAL METAL CONGRESS and EXPOSITION

Philadelphia Trade & Convention Center • October 17-21

Sponsored by the AMERICAN SOCIETY FOR METALS *Metals Park • Novelty, Ohio*

Cooperating Activities: The Metallurgical Society of AIME; Society for Non-destructive Testing, Inc. Associations presenting technical sessions in cooperation with ASM: Metal Powder Industries Federation; Metal Treating Institute; Ultrasonic Manufacturers' Association; Industrial Heating Equipment Association; Special Libraries Association—Metals Division; American Society for Testing Materials—Committee B-9; and extensive research and engineering programs of the American Society for Metals, and ASM Seminars.

TEC PRESENTS AN UNBEATABLE FORMULA FOR TOP TIG WELDING!

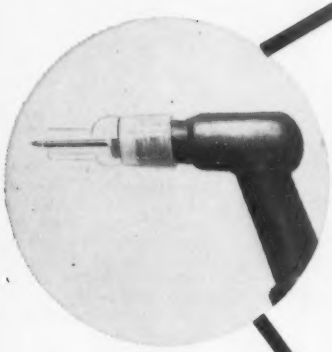
TEC Visuweld Watercooled Torch

The standard bearer of the quality TEC Torch line proven by scores of satisfied users throughout the country.

Lightweight, and maneuverable, the TEC water-cooled operates from 3 to 350 Amps with maintenance free efficiency because of one-piece torch head design which eliminates troublesome wearing or leaking.

Exclusive "tip-of-torch" water cooling affords continuous welding even at 350 Amps. No finer welding instrument on the market.

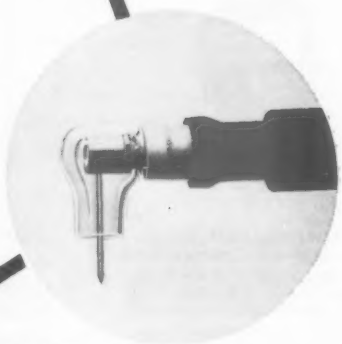
FEATURING
TEC Visuweld Vycor* Transparent Gas Nozzles*



TEC Air-cooled Torch

This smooth operating newcomer to the TEC line is gaining plaudits for its great gas savings and its effortless performance.

Rugged and durable due to one piece construction of phenolic plastic reinforced with macerated fiber glass, the TEC Air-Cooled utilizes both standard and off-set Visuweld transparent nozzles.



TEC Spot Gun

Here's the one spot gun that has been engineered not to create problems, but to solve the production gap between resistant welding and arc welding.

Lightweight, "tip-of-torch" cooled, and trouble-free the TEC Spot Gun enables welding all gauge thickness joints from only one side efficiently and economically.

TEC "Tiny Giant" (Pencil) Torch with Off-set Nozzle)

Only the magic of TEC ingenuity could have developed so simple, yet revolutionary an innovation.

TEC's off-set nozzles and chucks convert the TEC watercooled and air-cooled torches into miniature torches which enable TEC TIG welding in less than 1½ inches of space!

You always have the winning formula when you specify TEC for your TIG welding requirements. Dedicated to producing the finest possible equipment in the industry, TEC products have proven time and time again that they out-perform all others . . . that tig welding can be more economical, maintenance free, and can produce results never before achieved. See your nearest TEC distributor today or contact TEC directly for personal service.

** Vycor is a registered trade name of Corning Glass Works, Inc.*

TEC TEC TORCH COMPANY, INC., CARLSTADT, N. J. Manufacturers of Visuweld Equipment

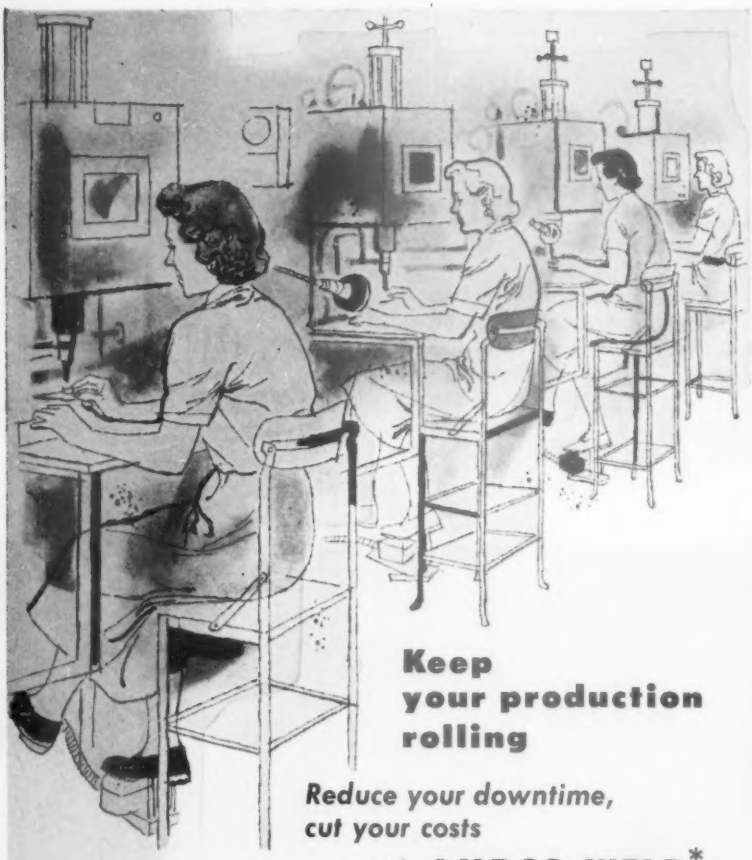
For More Information Circle No. 69 on Reader Service Card.

Circle No. 46 on Reader Service Card. ⟶

World's largest single-engine crawler welded with M&T Murex electrodes

The giant Caterpillar D9 tractor is a mountain of earth-moving muscle with a pull of 67,190 lbs. Using its seven-roller tracks, the Cat crawler can claw into the earth, push huge boulders, maul tons of dirt. The average tractor is dwarfed by the size of this monster: 23 feet long and weighing over 75,000 pounds, with equipment. In building its D9 line of crawlers, Caterpillar Tractor Co. used Murex electrodes – products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

M&T MUREX
PRODUCTS FOR BETTER WELDING



Keep your production rolling

Reduce your downtime, cut your costs

. . . with* AMPCO-WELD* *resistance-welding products

Strict laboratory control over all manufacturing processes, unique with Ampco Metal, pays off for you in consistently uniform, quality products. You receive extra bonuses with AMPCO-WELD that keep your production rolling. Extra bonuses such as consistently high electrical conductivity combined with strength and toughness beyond the limits usually available. These are important characteristics which reduce sticking to the work, increase resistance to mushrooming and wear at high temperatures.

AMPCO-WELD seam welding wheels — "off-the-shelf" shipment of rough forgings or finished blanks. Rapid delivery of wheels machined to your specifications.

AMPCO-WELD spot-welding tips — available in all standard-straight and cold-bent types for immediate delivery.

AMPCO-WELD bar and rod — shipment of round, hex, square, or rectangular bars of standard sizes without delay.

AMPCO-WELD holders — delivery from stock of straight, offset, or universal ejector types. Offset and universal holders have interchangeable sockets for No. 1 and 2 tapers.

Don't put up with downtime — order AMPCO-WELD products today. They always meet or exceed RWMA specifications. Contact your local AMPCO-WELD Distributor or write for latest literature. RW-17

AMPCO

Sole producer of genuine Ampco Metal

AMPCO METAL, INC.
*Reg. U. S. Pat. Off.

Dept. 177-I • Milwaukee 46, Wisconsin
West Coast Plant • Huntington Park, California

For More Information Circle No. 9 on Reader Service Card.

MEN ON THE MOVE

continued from page 16

APPOINTMENTS:

K. Dale Swanson has been appointed abrasive engineer for the southwestern section of Los Angeles by Norton Company, Worcester, Mass.

W. Blake Tripp is plant manager at United Welders, Inc., Bay City, Mich.

ELECTIONS:

MULLEN above, left

SMITH above

NORCROSS left

H. A. Mullen was elected president of the Resistance Welding Alloy Association at that group's annual meeting. Mr. Mullen is manager of the Resistance Welding Department of Ampco Metal, Inc., Milwaukee. New vice president is **R. H. Imes,** assistant to the general sales manager, Mallory Metallurgical Co., a Division of P. R. Mallory & Co., Inc.

Albert J. Smith has been elected vice president of the McKay Company, Pittsburgh. Mr. Smith is in charge of Electrode Division sales.

James E. Norcross has been elected to the Board of Directors of the Arcos Corp., Philadelphia. Mr. Norcross, executive vice president of the company, fills a vacancy left by the recent death of Royal D. Thomas.

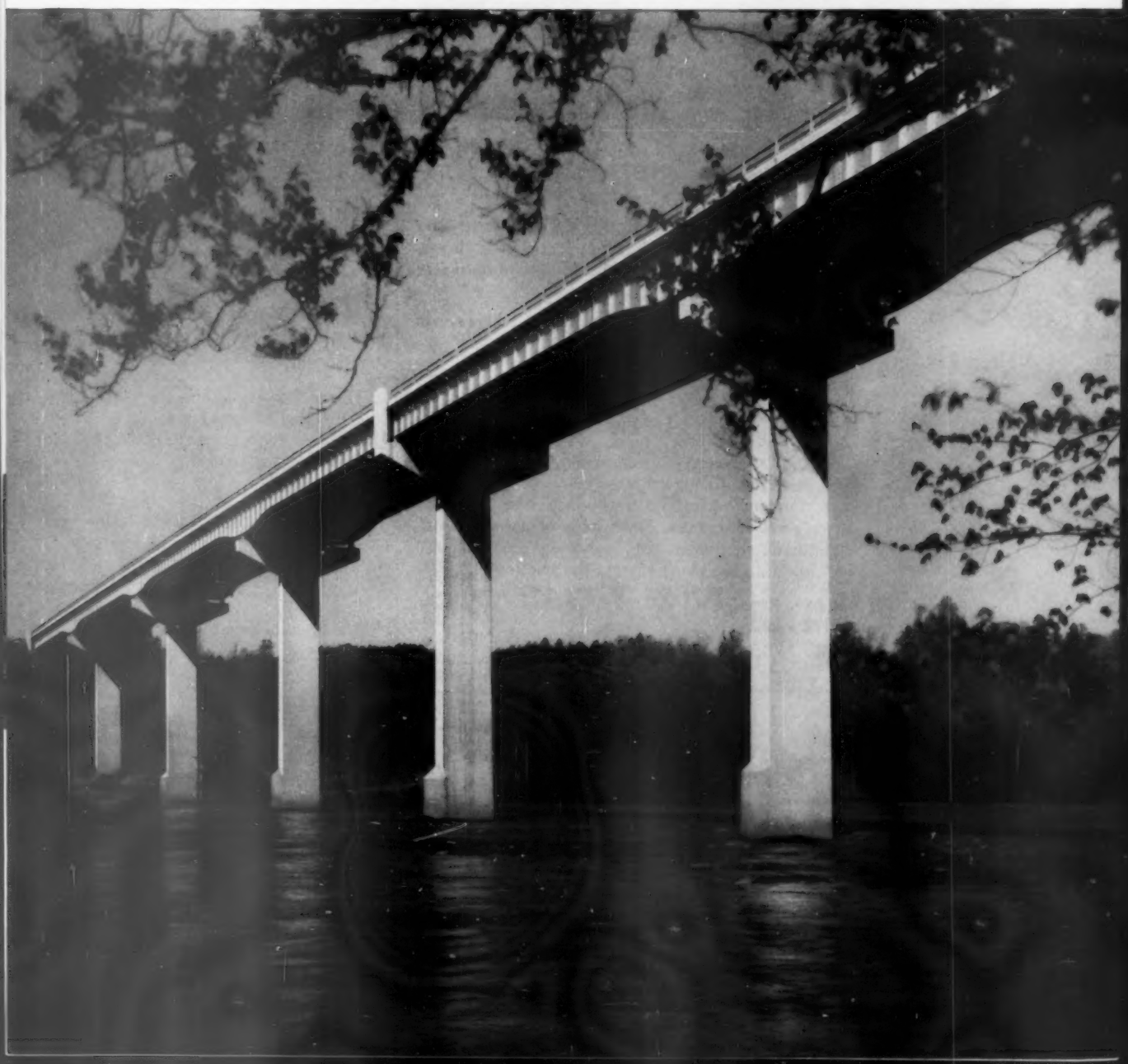
continued on page 22

Circle No. 47 on Reader Service Card. ⟶

Nation's top-award-winning bridge welded with M&T Murex electrodes

Some time ago, the American Institute of Steel Construction announced its awards for the most beautiful bridges opened during 1958. There were over 100 entries in four classifications. Top award in its class went to the Louie Morris Memorial bridge in Hartwell, Ga. This was the sole first award to go to a welded bridge. On this winner, all welding was done by Calvert Iron Works with M&T Murex electrodes – products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

M&T MUREX
PRODUCTS FOR BETTER WELDING



Complete your shop with this modern metallizing installation

WIRE GUN
Sprays any metal that can be drawn into wire form.

POWDER GUN
Sprays hard-facing alloys and ceramics in powder form.

Without metallizing no maintenance or "job" shop can offer the same complete service as the shop that uses industry's low-cost "putting-on" tool.

With modern, low-cost metallizing equipment you can spray carbon steels, stainless, babbitts, brass, bronze, nickel, aluminum, tin, zinc, special hard facing alloys including tungsten carbide.

- Save up to 90% of replacement costs on machine repair jobs
- Do your own hard-facing at high speed, low cost
- Apply long-wearing, corrosion-resistant coatings

A real opportunity for the smaller shop

Thousands of large, well-known companies and shops have been metallizing users for many years, not only in maintenance work but in production applications on original equipment. Now, with modern low-cost metallizing equipment this high-speed "putting-on" tool is within the reach of even the smallest shop.

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies
1179 Prospect Ave., Westbury, L.I., N.Y. Telephone: Edgewood 4-1300 Cable: METCO
In Great Britain: METALLIZING EQUIPMENT CO., Ltd., Chobham-near-Woking, England

FREE BULLETIN

Send off the coupon for detailed information — find out how a metallizing installation can pay for itself in a very short time. No obligation, of course.

METCO INC.
1179 Prospect Ave., Westbury, L. I., New York
Please send me free bulletin on metallizing.

Name _____
Title _____
Company _____
Address _____
City _____ Zone _____ State _____

For More Information Circle No. 50 on Reader Service Card.

MEN ON THE MOVE

continued from page 16

PROMOTIONS:

PRICE

HUGHES

William E. Price has been named advertising manager of General Dynamic's Liquid Carbonic Division, Chicago. He had been equipment sales manager.

Allan B. Hughes has been appointed West Coast District Manager for Bay State Abrasive Products Co., Westboro, Mass.

Amperex Electronic Corp. has named **Bertram Green** a Section Head in its Applications Engineering Department. He will be in charge of industrial tube applications.

Maurice Gormly has been named manager of Cincinnati Milling Machine Company's Products Division.

Harold A. Hallstein is new general field sales manager of Gregory Industries, Inc., Lorain, Ohio. The company makes stud welding equipment.

Robert S. Baker has been appointed vice president-manufacturing of the American Brass Co., Waterbury, Conn.

Manager of welded tubing sales for Babcock & Wilcox Company's Tubular Products Division, Beaver Falls, Pa., is **John A. Menster.**

Herbert T. Florence has been elected president and general manager of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

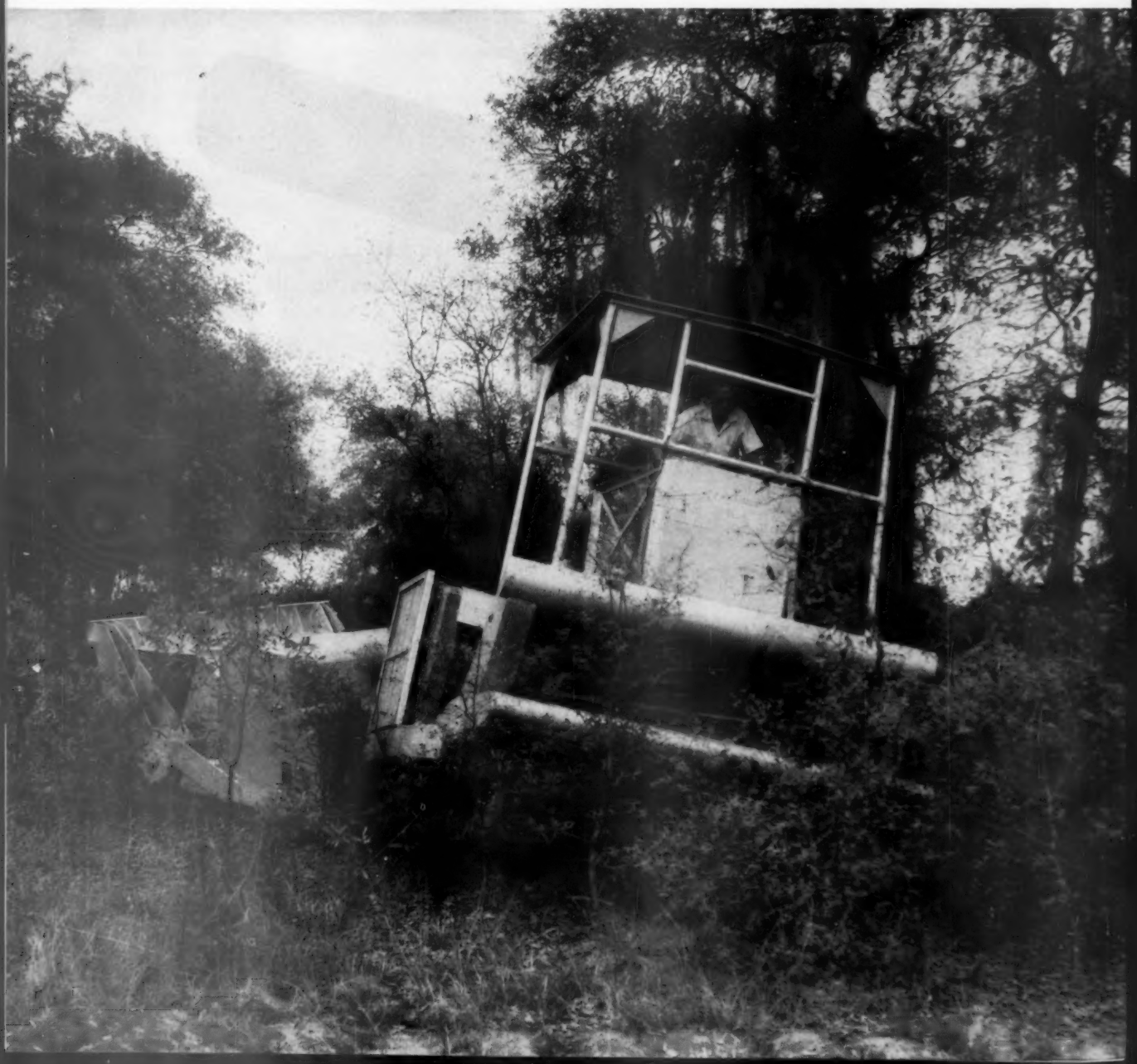
A. M. Eastberg has been added to the sales staff of the Milwaukee office of A. O. Smith Corporation's Welding Products Division.

Circle No. 48 on Reader Service Card. ⟶

World's toughest "lawnmower" welded with M&T Murex electrodes

Thicket, field, forest—all would be duck soup for this 16-ton husky. The first of its kind to be self-propelled, the Marden brush cutter can clear a seven-foot swath through dense undergrowth with trees up to 6" in diameter. And as it clears, it forces the vegetation into the ground to act as humus. In building its rugged brush cutters, the Marden Manufacturing Company uses M&T Murex dependable electrodes—products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

M&T MUREX
PRODUCTS FOR BETTER WELDING



The NEW «Adjustable Tension» DURO HOLDER

Light Weight 13 OZ.
300 Amperes ¼" Rod

Easy adjusting of Spring Tension for your requirements.

Streamlined design for good visibility of the work by the operator

Low lever for Easy Opening

New type cable connection prevents fraying of cable.

Pivot pin held in place by insulator.
No riveting.
Easy servicing.

Heavy wall fibre handle.

Replaceable copper alloy jaw.

Turn screw for easy adjustment of spring tension for **YOUR requirements.**

All parts easily replaced at low cost.

Modern design and manufacturing methods enables us to furnish this most modern light weight holder at this low price:

Model A3T 13 oz. (Aluminum) **$5.95 List**

Model B3T 20 oz. (Bronze) **$6.95 List**

Less usual quantity discounts

For further information write:

THE DURO ENGINEERING COMPANY
61 OREGON AVENUE • HAMDEN 17, CONN.

For More Information Circle No. 19 on Reader Service Card.

AWS Holds Fall Meeting In Pittsburgh

PITTSBURGH: The American Welding Society's National Fall Meeting will be held here September 26-29 at the Hotel Penn-Sheraton.

TECHNICAL SESSIONS

Seventeen technical sessions will be held at which 51 different papers will be presented. Each session will deal with a particular process or subject. This makes it possible to attend all lectures on a given subject or process instead of having to miss important papers being given simultaneously.

The following subjects will be covered: Welded structures; resistance welding, brazing, electrodes and techniques, research and weldability, processes, rebuilding and surfacing, nondestructive testing, missiles, cutting, aluminum, high alloys, and fabrication of weldments.

PLANT TOURS

Plant tours have been arranged. Tentatively scheduled are trips to the Shippingport Atomic Power Station of the Duquesne Light Company, the American Bridge Company, New Kensington Works of Alcoa, and Brackenridge Works of Allegheny Ludlum Steel Company.

AWS MEETINGS AND CONFERENCES

Conferences, councils and Board of Directors meetings are scheduled. A Section Officers' Meeting will be held to discuss sectional problems. The Educational Chairman and Publicity Chairmen of all AWS Sections will also have special meetings.

NWSA Grants $10,000 To Ohio State University

PHILADELPHIA: The National Welding Supply Association has donated $10,000 to Ohio State University in order to jointly produce a film promoting career opportunities in the welding engineering field.

The film is being developed under the direction of Professor Roy B. McCauley, chairman of the Department of Welding Engineering at Ohio State. Arrangements and liaison work are being handled by William A. Rice, chairman of the NWSA Publicity Committee.

more news on page 27

THE RESISTANCE WELDER MANUFACTURERS ASSOCIATION held its third regular business meeting of the year in Grand Rapids, Michigan. Attending were representatives of eight major companies, including Federal Machine and Welder Co., Goodrich Welding Equipment Corp., Kirkhof Mfg. Corp., National Electric Welding Machines Co., Precision Welder and Flexopress Corp., Resistance Welder Corp., Swift Ohio Corp., and Taylor-Winfield Corp. At the speakers' table are William H. Carrigan, president of RWMA; guest speaker Stuart Rockafellow of Robotron Corp.; and R. Bruce Wall, RWMA's secretary-treasurer.

Colossal Crawler

Beautiful bridge

Mammoth "mower"

A tractor that shoves huge rocks and mounds of earth . . . a bridge that wins an award for beauty . . . a brush-cutting machine that clears dense undergrowth . . . all must be both carefully engineered and strongly built to do their jobs properly. It's significant that all were welded with M&T Murex electrodes.

On one important job after another, Murex electrodes have met the most demanding specifications. With more than 1000 types and sizes to choose from, you're almost *sure* to find a Murex electrode that exactly meets your requirements. Send for "electrode selector" booklet.

M&T MUREX welding products

METAL & THERMIT CORPORATION
General Offices Rahway, New Jersey
Circle No. 49 on Reader Service Card.

Welding Problem?

CONSULT YOUR WELDING SUPPLY DISTRIBUTOR

Your welding supply distributor has a wealth of information for you. Let him demonstrate how you can hold trouble free welding in the palm of your hand.

Cool, efficient operation is the key to better profits in the welding industry. Your welding supply distributor will be glad to share his knowledge with you. Why not take a few minutes to talk over your welding troubles with him. He knows your problems and will get you back in trouble free operation in a jiffy.

HI-AMP

354 W. ADAMS ST., JACKSON, MISSOURI

Insist On HI-AMP Accessories From Your Welding Supply Distributor

LENCO, Inc. JACKSON, MO.

For More Information Circle No. 41 on Reader Service Card.

IN SAN JOSE, working exhibits of more than 20 manufacturers will be on display in 3rd Western Welding Show. Last year's exhibits are shown here.

IN BOSTON, Regional Welding Conference features a full day of technical sessions. Some of the people who attended last year's sessions are shown here.

Local A.W.S. Groups Sponsor Educational Meetings

THEY'RE CALLED Welding Conferences, Educational Lecture Series, or Welding Shows. And, they're held from Massachusetts through the Middle West and on out to California.

But, these educational meetings all have the same purpose. They're sponsored by local American Welding Society groups to keep people up-to-date on the latest welding techniques and equipment.

BOSTON, MASSACHUSSETTS

The fifth annual New England Regional Welding Conference and Exhibition will be held in Boston on October 13 and 14. The Boston Section of the American Welding Society will be host to this event which is sponsored by all eight of the AWS Sections in District 1. A. J. Rosenberg, General Electric Co., is in charge.

On the first day a series of six technical papers will be presented on welding in defense. Speakers will discuss welding of ships, aircraft, missiles and rockets. The program will be presented in conjunction with a welding show at which close to 100 manufacturers will have exhibits.

On the second day, no technical sessions are scheduled but the show will be open.

CHICAGO, ILLINOIS

The third annual Education Series held by the Chicago Section of the AWS will take place on five consecutive evenings starting September 22. Sessions will cover various forms of arc and resistance welding.

R. E. Oller, Commonwealth Edison Co., is chairman of the Chicago Section's Educational Activities Committee.

SAN JOSE, CALIFORNIA

The third annual Western Welding Show is sponsored by the Santa Clara Valley Section of the AWS in San Jose on October, 13-15. The purpose of the show is to bring the latest welding developments to users in the West Coast and Rocky Mountain areas.

A complete program of technical papers will be presented in conjunction with the show.

Arnold Otto is Show Chairman.

SALESMEN and their factory instructors in front of A. O. Smith's Elkhorn Wisconsin, plant.

Product Performance Keynotes A. O. Smith Sales Meeting

ELKHORN, WISCONSIN: Nationwide welding sales for the A. O. Smith Corporation got a shot in the arm recently when more than 60 salesmen and sales managers of A. O. Smith's Welding Products Division met here to learn how to do a better job in 1960.

Main emphasis of the week-long shirt sleeve conference was on how to sell product performance and value in the face of price cutting trends.

R. W. Raney, general sales manager for the division, was in charge.

more news on page 28

Hackney MILWAUKEE high pressure cylinders are...

SMOOTH-SURFACED

- Cut maintenance costs—uniform surfaces clean easily, paint quickly.
- Have eye appeal—no crevices, cracks or ridges. Modern appearance for industrial and medical applications.

UNIFORM...DURABLE

- Every size has uniform capacity, controlled weight—filling, handling and record-keeping are simpler.
- Ruggedly constructed for long life. Hackney has spelled durability and quality workmanship since 1902. Every cylinder exceeds ICC specifications.

QUALITY-BUILT

- Hackney quality costs no more. And it gives you extra features such as accurate threading, neater appearance and legible stamping.
- Available in a complete range of sizes and shapes to meet any gas requirement—from small medicals to 220's, 250's and 300's (cu. ft.).

Economical, strong, safe Hackney cylinders meet your needs for every type of industrial gas. Central location means faster shipping with lower freight charges. Your nearest Hackney representative will be glad to give you complete specifications and quote prices.

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

1473 South 66th Street, Milwaukee 14, Wisconsin

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CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

For More Information Circle No. 45 on Reader Service Card.

NWSA Schedules 1960-61 Meetings

PHILADELPHIA: Dates and locations for its annual series of zone meetings and its 17th annual convention have been announced by the National Welding Supply Association. They are as follows:

Central Zone: September 15-16, Sheraton Cleveland Hotel, Cleveland.

Eastern Zone: September 19-20, Hotel Commodore, New York City.

West Central Zone: October 17-18, Hotel Muehlebach, Kansas City, Mo.

Western Zone: October 21-22, Ambassador Hotel, Los Angeles.

Southeastern Zone: November 28-29, Hillsboro Hotel, Tampa.

Southwestern Zone: December 1-2, Hotel Roosevelt, New Orleans.

Annual Convention: May 8-10, 1961, Hotel Commodore, New York City.

Chemetron Makes Fittings In Mexico

MEXICO CITY: Welding fittings for petroleum, chemical, and other industrial piping are now being manufactured here by Tube Turns de Mexico S.A., a subsidiary of Chemetron Corp., Chicago. The subsidiary has been making flanges here since 1957.

Eutectic Opens New Welding Center

PHILADELPHIA: The newest and largest of its Service and Training Centers was recently opened here by Eutectic Welding Alloys Corp. at 3901 M. Street. The facility will serve as headquarters for the company's Middle Atlantic Division.

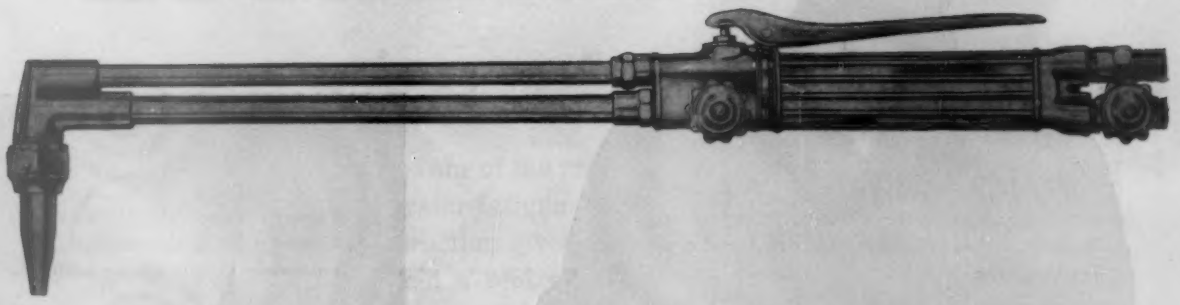
Diamonite Expands

SHREVE, OHIO: Diamonite Products Mfg. Co., manufacturers of high alumina ceramic parts and components, announces the completion of new manufacturing facilities with 12,500 square feet of added floor space. This is the company's third expansion of plant facilities in the last four years.

more new on page 79

Circle No. 70 on Reader Service Card.——→

WHAT FEATURES DO *you* NEED IN A CUTTING TORCH?



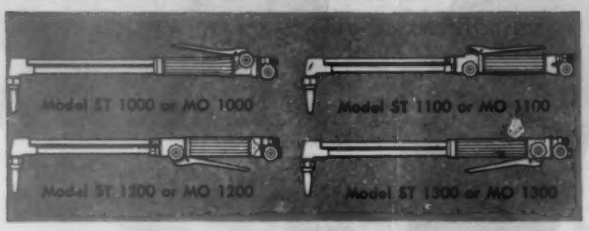
In the Victor line you'll find all the features you want! You have a choice of preheat gases, heads, lever positions, lengths, wide operating range.

FOR ACETYLENE: Model ST and MO series hand-cutting torches.

OTHER FUEL GASES: The new Model STN series hand-cutting torches with improved injector type gas mixers operate on either low (2-6 oz.) or medium pressure natural or propane type gases. This design has been thoroughly field tested and proven for maximum performance and efficiency.

HEADS: You can have either Everdur bronze (ST) or Monel (MO) head, angled at 90°, 75°, 180° . . . or 45° (ST models only).

OXYGEN LEVER POSITIONS: Four, as shown.



LENGTHS: 21", 27", 3' and 4'. (Special lengths on request).

OPERATING RANGES: Standard ST and MO models cut to approximately 8", using acetylene tips to size 5. Heavy duty (HD) models are available for work requiring tips above size 5, for gouging, scarfing, scrap cutting, etc. The new STN series use natural or propane type tips to size 8.

Remember, you can get Victor cutting attachments and machine cutting torches for use with acetylene—also for use with low or medium pressure natural or propane type gases. For the finest choice in cutting equipment, call on your Victor dealer now.

VICTOR EQUIPMENT COMPANY

844 Folsom St.
San Francisco 7

3821 Santa Fe Avenue
Los Angeles 58

1145 E. 76th St., Chicago 19
J. C. Menzies & Co., Wholly-Owned Subsidiary

66

VICTOR ...ing

MFRS. OF WELDING & CUTTING EQUIPMENT; HIGH PRESSURE AND LARGE VOLUME GAS REGULATORS; HARDFACING RODS, BLASTING NOZZLES; COBALT & TUNGSTEN CASTINGS; STRAIGHTLINE AND SHAPE CUTTING MACHINES.

"Man, we never had it so good!"

BAY STATE'S NEW "KOOLIE HAT" Wheels

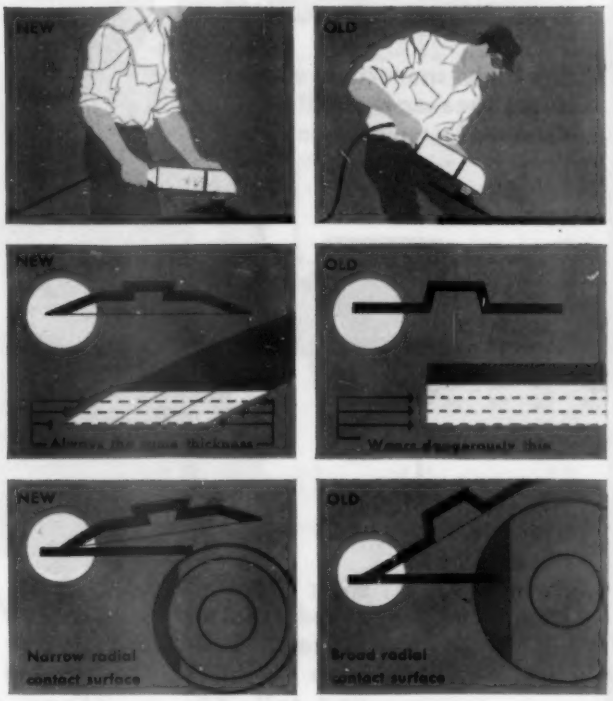
are easier, safer and faster . . .

This new wheel shape removes one of the prime causes of accidents in portable grinding and blending, by cutting operator-fatigue. It increases cutting speed, too. Triple-layer, resin-bonded fiberglass construction gives Bay State's new "KOOLIE HAT" wheels extra strength, durability and a controlled contact area so important to portable snagging wheel users.

• Easier Operation
"Koolie Hat" wheel is held at 4° to 5° angle to the horizontal instead of 25° to 30° . . . requires less pressure to hold grinder steady . . . virtually eliminates jitter and bounce, due to extended peripheral contact. Operator grinds in relaxed position with both arms extended about equally... fatigue drops . . . accident rate goes down . . . production climbs.

• Extra Safety
"Koolie Hat" shape ensures uniform wear of all three layers of abrasive at once . . . even when wheel is held flat for smoothing and cleaning. This eliminates danger that results when conventional disc-wheels wear thin over entire surface (see diagram). Prevention of heat build-up also reduces danger of breakage due to heat cracks.

• More Uniform Speed
New "Koolie Hat" shape provides a narrow, radial contact surface between wheel and work. This means that wheel speeds stay high, ensures fast, efficient removal of metal and prevents heat build-up.



These remarkable new wheels are available in two sizes: 7" x ¼" and 9" x ¼". Your Bay State distributor or direct representative is ready now to demonstrate on your work, at your plant. Write today.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

For More Information Circle No. 12 on Reader Service Card.

THE GAUGELESS REGULATOR

AN ORIGINAL **HARRIS** DEVELOPMENT AND A ***PROVEN PRODUCT***

The No. 77 was originally designed, developed and manufactured by Harris to meet industry's need for a completely new, damage-proof gaugeless regulator.

It has proven itself to be just that, under rugged operating conditions.

It's a rugged regulator and completely safe! Possibility of damage — internal or external — has been virtually eliminated.

Acceptance of this regulator around the world stems from many reasons, as shown below. Check with your Harris distributor today.

Adjusting screw can be left in any position without damage to seats or diaphragms.

Thimble protects adjusting screw threads and shows pressure adjustments.

Easily read working pressure indicator replaces low pressure gauge.

Approved by underwriters laboratories.

Short inlet connection reduces breakage, readily removed for replacement.

Nut supported over inlet stem to prevent damage to stem seat.

High pressure cylinder content indicator, indicates ¼, ½, ¾ and full. Replaces high pressure gauge.

First and second stage safety valves.

MODEL NO.	TYPE	DELIVERY RANGE POUNDS
X-77	Oxygen	0 to 200
77	Oxygen	0 to 100
77-A	Oxygen	0 to 50
77-P	P.O.L. Acetylene	0 to 15
X-77-P	P.O.L. Propane	0 to 50
77-D	Coml. Acetylene	0 to 15
X-77-D	Coml. Propane	0 to 50

3114-HC

HARRIS

Building World-wide Customer Confidence with Advanced Design Welding and Cutting Apparatus

THE HARRIS CALORIFIC COMPANY, 5501 CASS AVENUE, CLEVELAND 2, OHIO

For More Information Circle No. 30 on Reader Service Card.

Facts At Your Fingertips

If you want details about products described or advertised in this issue, circle the number on the card that corresponds with the number under each advertisement or product description.

WELDING DESIGN & FABRICATION

September 1960, Circle item numbers for additional information about products described and advertised in this issue.

ADVERTISEMENTS

1	13	25	37	49	61	73	85	97	109	121	133	145	157
2	14	26	38	50	62	74	86	98	110	122	134	146	158
3	15	27	39	51	63	75	87	99	111	123	135	147	159
4	16	28	40	52	64	76	88	100	112	124	136	148	160
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6	18	30	42	54	66	78	90	102	114	126	138	150	162
7	19	31	43	55	67	79	91	103	115	127	139	151	163
8	20	32	44	56	68	80	92	104	116	128	140	152	164
9	21	33	45	57	69	81	93	105	117	129	141	153	165
10	22	34	46	58	70	82	94	106	118	130	142	154	166
11	23	35	47	59	71	83	95	107	119	131	143	155	167
12	24	36	48	60	72	84	96	108	120	132	144	156	168

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NEW PRODUCTS

200	206	212	218	224	230	236	242	248
201	207	213	219	225	231	237	243	249
202	208	214	220	226	232	238	244	250
203	209	215	221	227	233	239	245	251
204	210	216	222	228	234	240	246	252
205	211	217	223	229	235	241	247	253

FREE LITERATURE

300	306	312	318	324	330	336	342	348
301	307	313	319	325	331	337	343	349
302	308	314	320	326	332	338	344	350
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My job title _____

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CLEVELAND, OHIO

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These cards are your tickets to this prompt service. Use them to secure details about any item in this issue that has a key number. For instance:

ADVERTISEMENTS — a showcase of the latest in components, equipment & techniques.

NEW PRODUCTS — brief descriptions of significant new products and materials.

NEW LITERATURE — offerings of new catalogs, data books, price lists, and other valuable reference material.

NEW FROM WESTINGHOUSE

BALTOGRAPH 300 PENETRATES UP TO 4" OF STEEL

permits 360° radiography and can be coned down to a single beam . . . yet weighs only 136 lbs.

This is the first industrial X-ray unit designed specifically to meet *all* radiographic inspection requirements, from thin aluminum up to 4" thick steel. Simple to operate . . . requiring only a few hours instruction.

For a free demonstration—at your plant or job site—just call, wire, or write to Mr. Dan Maus, X-ray Department, Westinghouse Electric Corporation, 2519 Wilkens Avenue, Baltimore 3, Md.—*You can be sure . . . if it's Westinghouse.*

WXR-31720

SPECIFICATIONS

X-ray Head

X-ray tube, lead shielding, HT transformer, filament heating transformer, and automatic thermal cutoff device are all mounted in a single lightweight housing.

X-ray portal: Total X-ray beam is 360° circumferential
Focus size: 3 x 3 mm
Inherent Filtration: Low
Shielding: 5 mm of lead
Power rating: Self-rectified 300 KVP-3MA
Weight: 136 lbs.
Dimensions: 46¼ long, 12¼ diameter

Control Panel

Hermetically-sealed penetration meter, penetration selector, MA control, and automatic push button reset timer mounted in rugged metal cabinet.

Power Supply: 115 or 230 volts, 60 cycles, single phase
Weight: 41 lbs.
Dimensions: 15" x 12" x 7"
Also included: 25' and 60' connecting cables and individual carrying cases.

Westinghouse

For More Information Circle No. 73 on Reader Service Card.

the product / the welding

Will Aluminum

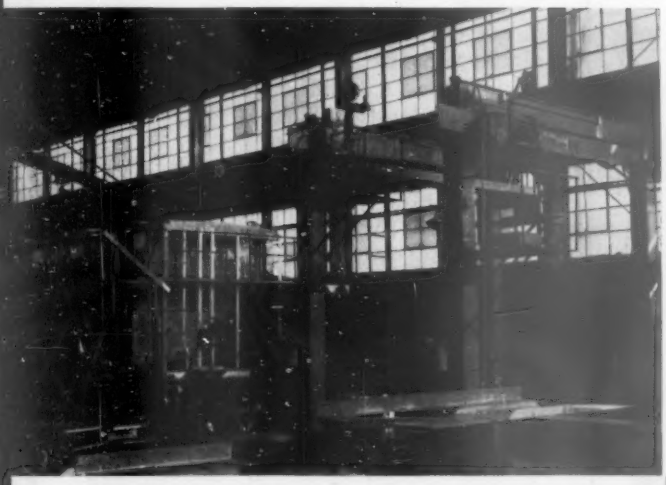
IN BRIEF: Welded aluminum freight cars offer significant advantages to the American railroad industry.

ALUMINUM CARS can carry greater payloads with less dead weight so they're more economical in the long run although they cost more. They need no painting and they resist corrosion. Welding provides strong, leak-proof joints that make possible moisture-tight construction.

That's why the American railroads have their eyes on welded aluminum covered hopper cars. Magor Car Corporation, Clifton, N. J., is building 455 of these 100-ton capacity cars for the Southern Railway System.

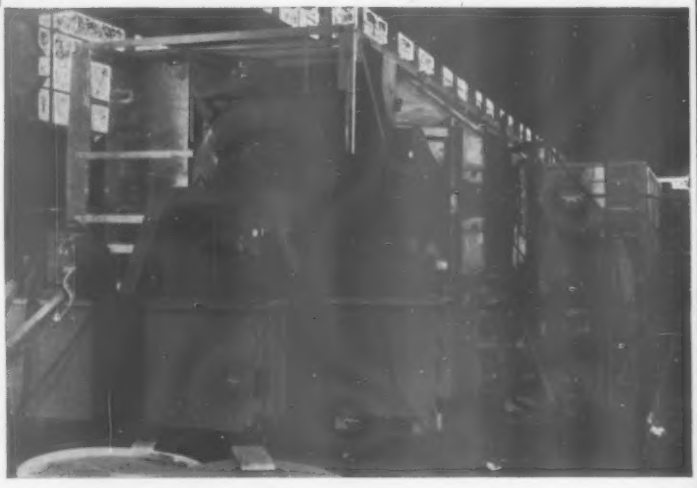
DESIGN DETAILS

Two hundred cars will be 2605-cubic-foot twin-



LONGITUDINAL SEAMING of car roofs is done at first station (right). Cross welds on roofs are made at second station (left). All fixtures are equipped with air cylinders that hold the work while welding takes place.

HEAD AND TAILSTOCK unit positions cars for assembly and semi-automatic welding.



SEPTEMBER, 1960
Welding Design & Fabrication
ESTABLISHED IN 1930 AS INDUSTRY & WELDING

Replace Steel In Welded Freight Cars?

hoppers for cement, 180 will be 3818-cubic-foot triple-hoppers for alumina, and 75 will be 4713-cubic-foot quad-hoppers for feed and grain. The triple- and quad-hoppers probably are the biggest covered hoppers ever built. The quad-hoppers are almost 60 feet long, 11 feet longer than ordinary 3-hopper steel cars.

The 2605-cubic-foot car is five tons lighter than a comparable car made of low-alloy, high-tensile steel. And, it is nine tons lighter than one made of open hearth steel. The weight saving is proportionally higher on the larger models.

Magor has been building freight cars for many years, but making welded aluminum cars is something fairly new for them. Before this job for Southern Railway, the company had built some welded aluminum gondola cars to carry ore for an aluminum company. The covered hopper cars are more complicated. To simplify fabrication, Magor made full use of aluminum extrusions. Various special, low-cost shapes were used. In steel Magor would have been limited to stock mill shapes, or they would have had to pay a premium for specials.

The market for aluminum railroad cars has barely been touched. Magor's welding and production engineers feel the speed with which this market develops will depend on how fast the welding industry brings out reliable production equipment.

MATERIAL DETAILS

The aluminum hopper cars are made of 5083-H-113 alloy (Reynolds) plate and sheet; the extrusions are 5083-H-112; welding wire is 5356. Plate thicknesses vary from 3/16 inch for roof sections, to 5/16 inch for sides and 5/16 to ½ inch for slopes.

On an average day, the plant uses about 75 reels of 1/16 inch welding wire, 26 reels of 3/64 inch wire, and 18 reels of 3/32 inch wire.

They dip smaller parts in a hot solution of Oakite 33 to remove grease and oxide, then rinse. Larger parts are wire brushed, washed with the same solution, and rinsed.

FABRICATION

Nearly all welding—both automatic and manual—is done with direct current and reverse polarity. Welding is done on special fixtures and positioners furnished by Unique Equipment, Inc.

All consumable electrode welding is done using argon shielding gas. This gas is piped through the plant's old oxygen system which had been purged with nitrogen.

The car is built on an assembly-line, except for subassemblies that go into the main sections. The main sections are the underframe, the sides, and the car body.

UNDERFRAME

The underframe consists of the center sill, bolsters, and end sills.

The center sill, or backbone, consists of two steel, mill-rolled Z-sections, cut, punched, and prepared for welding draft lugs and ribs and draft key slots to the ends and inner face of each half-sill.

The two half-sills are jig-assembled and tacked to form the boxed sill. This is then placed under an automatic submerged arc welder to make a continuous 9/16-inch butt weld the full length of the sill. First, the inside is sealed with a 3/16-inch diameter wire at 30 ipm, using 600 amps AC. Then the outside is sealed at 55 ipm, using a triple arc; twin ⅛-inch wires at 1250 amps DC and a trailing 3/16-inch wire at 750 amps AC. This gives overlapping penetration, with acceptable reinforcement and good surface finish.

The triple wire submerged arc welder has two welding heads. One feeds the single 3/16-inch wire and the other feeds two ⅛-inch wires.

continued on next page

Because deep penetration is not desirable in sealing the inside of the butt, only one welding head is used—with a single 3/16-inch wire. However, deep penetration is required on the outside. This is obtained by the two ⅛-inch diameter wires. Here the 3/16-inch trailing wire acts as a filler and gives the weld its smooth surface finish.

The sill is then jigged for the application of strikers, center fillers, bolsters and end sills, and is rotated for downhand welding.

SIDES

The sides consist of side sheets, top plate, side sill, and small parts.

Side sheets are placed in a jig, where the top plate and side sill are tacked, forming the top and bottom seams. Tacking is kept to a minumum so that roller pressure, applied in the next operation, will be more effective.

The side plus the top plate and side sill are rolled under a butt welding gantry where the top and bottom butts are welded against a steel backing bar. Air cylinders apply pressure through rollers from the gantry cross head. The 5/16-inch butt weld is applied at 18 ipm, using 3/32-inch wire at 350 amps and 30 volts.

The side section is now moved to the side stake gantry. Indexing holes locate the gantry and cross head over each stake. Air cylinders lock and press the stakes to the side. Two separate welding heads now weld the side of the stakes at 65 ipm, using 3/32-inch wire, at 375 amps and 29 volts. The heads are independent of each other, so if one fails the other still makes a good weld. A 2-man crew turns out 10 car sides a day here.

CAR BODY

The side is then rolled to the next station, where operators apply small parts, such as hand grabs and roping bars, and repair any work that needs it.

TRAVELING BEAM FIXTURE is used for longitudinal seam welding of car sides. Air cylinders hold work in position during welding.

The car body consists of body bolsters, center partitions, and hoppers.

The bolsters, partitions and hoppers are jig-assembled to the underframe, then removed and placed on shop trucks on the line. Sides are applied and the car moved down the line where all downhand welding is done and the roof supports applied.

Then the car is lifted from the track and placed in two mechanical roll over jigs, where it is rotated for downhand welding. The rotating fixture has a motor-driven headstock and hydraulically retractable tailstock. Retractable pins fit into the sill and grasp the car.

The car is then returned to the track, where the roof is applied and tack-welded. Then it passes under the first roof-welding gantry, where two automatic heads weld the roof sides seams to the side plates. At a second roof gantry, the cross roof butts are welded to the roof supports. Now hatches and a cat-walk are installed. The car is complete.

EQUIPMENT

Of the 2500 feet of welding in one of the smaller cars, 70 percent is automatic and 30 percent manual. Various makes of equipment are used.

Ronald P. Hubbard, Magor's welding engineer, says that the automatic equipment has been generally satisfactory, except that he would like simpler, easier-to-maintain controls.

Hubbard feels the manual, semi-automatic equipment could be greatly improved. Pull-type guns (3/64-inch wire) and push-type guns (1/16-inch wire) are used. Hubbard points out that the manual equipment works fine in pilot operations for expert welders. Less highly trained production workers have trouble.

What are some of the troubles?

Hubbard says the pull-type guns have worked satisfactorily, but they are too fragile. Hubbard would like to see a sturdier gun. The guns are not meant to be dropped, but they often are. Result: Too many broken handles and housings.

The push-type units don't fit tight quarters with the wire conduit being turned at nearly any angle. This causes the conduit to grip the wire and prevent its feeding. Then, an arc burns back to the copper guide tube, and you have to dismantle the gun, remove the wire, renew the tube and rethread the wire. Sometimes, you can grind down the burned-back contact tips and use them in the automatic welders, which use shorter tips, but costs for spares and replacement parts are nevertheless too high, Hubbard feels. Time lost as a result of burn-backs has often kept arc time as low as 30 percent.

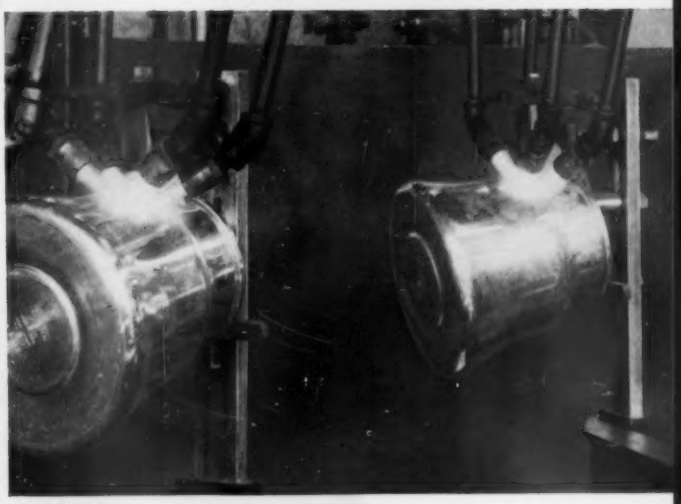
One way that Magor has been able to lick some of the troubles with manual push guns is to hang control boxes on shop-made swivels and booms. This keeps the wire from kinking. But when welding in confined quarters, this usually won't work. A gun that can be assembled and disassembled easier than present models would be welcome.

Individual plants that weld aluminum are learning much, Hubbard says, but they'd appreciate more cooperation from designers of welding equipment. • •

Automatic Brazing for Uniformity And Production

by C. S. WHITAKER, *Works Chief Engineer, Alcoa, Cooking Utensil Division*

TOOLING: Indexing table carries fixture-mounted pot assemblies past loading, heating, and unloading stations.



BRAZING: Fixed-distance burners converge on spout joint. Gas-air mixture and heating time are constant.

IN BRIEF: In the competitive utensil market, price and quality are important. Automatic brazing lowers the first, raises the second.

ONE OF THE MOST expensive steps in making aluminum coffee pots was welding the spout. That was before we switched to automatic gas-fired brazing using a machine developed by the Selas Corporation of America.

We make aluminum utensils in our Chillicothe, Ohio plant. They are sold through department and hardware stores. In this competitive market, you've got to sell quality at an attractive price.

We used to weld the pouring spout to the coffee pot by the oxyhydrogen process. The weld was sound enough. The trouble was we had to grind off the excess and polish it to make a nice-looking fillet.

Our engineers felt that brazing would avoid most of this grinding. They knew that in aluminum brazing the fillet is smooth, that it looks and acts like the aluminum base metal. True, you must use a flux, but it washes off in water. The only finishing a good braze needs is a light buffing.

Some thought was given to hand brazing, but our engineers decided it was too slow and not uniform enough. They thought automatic brazing was better; you have better heat control and get much higher production with it.

And so it proved. Now, one man brazes thousands of coffee makers each month and each joint is as good as the last. He's less tired than he used to be. There's less damage to the pots too, because they're handled less; the machine and controls are a part of the production line.

These conditions make automatic brazing uniform:

- Uniform heating
- Fixed burner-workpiece distance
- Fixed heating time
- Tooling

The pot body and spout are held in an indexing fixture designed by our engineers. The assembly indexes past loading, heating, and unloading stations.

Each heating station has four burners (two each side of the spout) equipped with ceramic flame screens. The gas-air mixture is controlled so the ratio is always the same no matter what the demand.

Naturally, different pot sizes take different heat settings. When it's time to switch, the operator has only to refer to a table to find the right mixture pressures. Then he sets each burner valve to it.

The brazing machine is next to the spout broaching machine. Broached as they're needed, spouts don't have time to oxidize. This saves storage and extra cleaning and fluxing.

Posts, spouts, and preformed lengths of brazing wire (in flux) are within easy reach of the operator. He hooks a pot on the fixture, positions the fluxed wire and the spout on the pot body, and closes the fixture. When the pot is brazed, the operator puts it on a conveyor, and loads another in the fixture.

With the Selas machine, one man turns out as many as 400 brazed coffee pots every hour. Rejects are few, fillets are clean and uniform, grinding is out. • •

An Iguana will be recognized...
by a *HERPETOLOGIST*
(specialist in reptiles)

For More Information Circle No. 42 on Reader Service Card.

potential savings will be recognized... by a *LINCOLN* man

(specialist in arc welding)

ANY IDEA which can cut welding time from 90 to 45 minutes on missile beams for the Army is darned important! That's exactly what happened in a New Jersey plant.

A LINCOLN Field Engineer was walking through the plant with the Welding Foreman and Plant Manager. Naturally he was interested in watching the welding operation on missile beams. A thought crossed his mind. He asked if he could demonstrate LINCOLN Jetweld electrodes on the beams. He rolled up his sleeves; took some Jetweld from the trunk of his car, and cut the welding time from 90 to 45 minutes. The weldors on the job did the same.

That afternoon the Field Engineer finished his plant tour and spotted some applications for Fleetweld 37 electrodes for welding sheet metal on trailer bodies. Again welding time was cut almost in half, cleaning time reduced and overall costs slashed to the bone.

Quite a day's work for one Field Engineer . . . but putting PROFIT into welding operations is part of each LINCOLN man's job. You can count on him to show you . . . not tell you how to cut costs and make more money.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

Call your LINCOLN Field Engineer today.

THE LINCOLN ELECTRIC COMPANY

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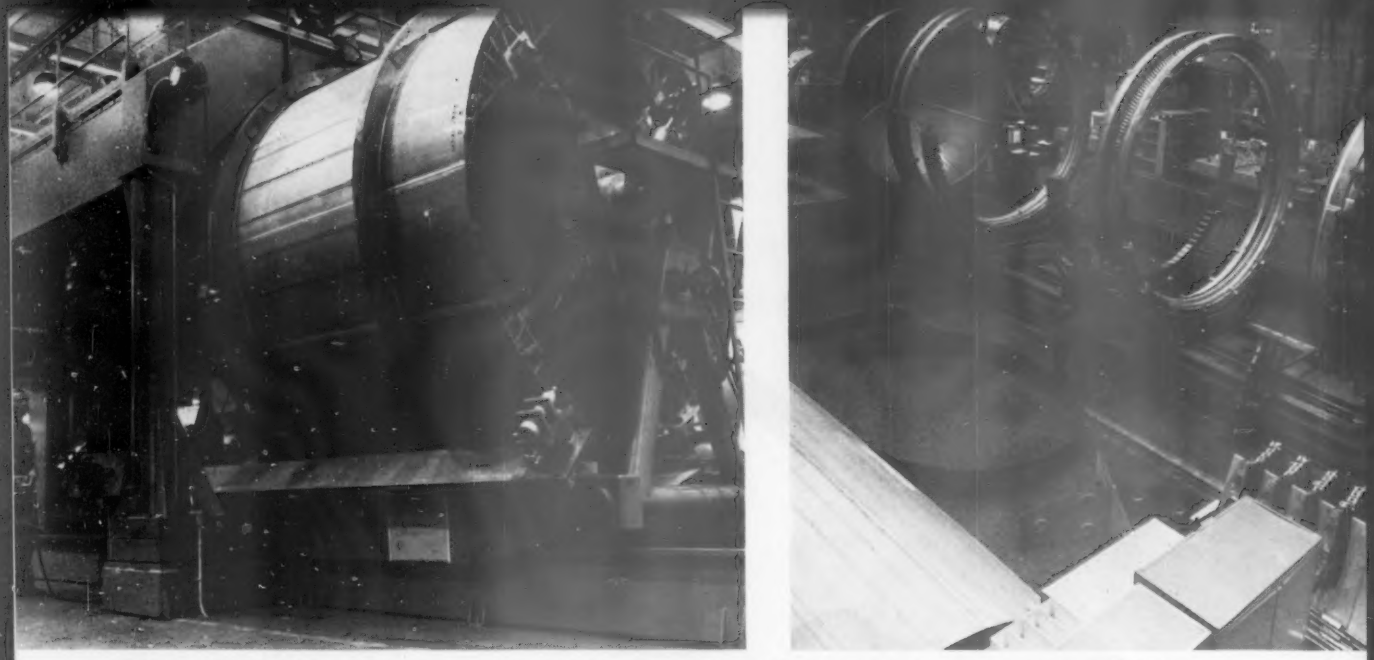
LINCOLN WELDERS

For More Information Circle No. 42 on Reader Service Card.



TITAN'S SKIN PANEL section is automatically welded in fixture (above, left). Three panel sections are first welded longitudinally to form quarter-barrel assemblies. Four of these assemblies are then girth welded to form complete barrel section. Tank domes are then welded automatically to barrel assembly in fixture (above, right). In left foreground is a section of a quarter-barrel assembly.

Techniques For Fabricating

IN BRIEF: New forms and applications of conventional processes are used. These include automatic welding in a variety of special fixtures, tape-controlled and chemical milling, and stretch forming.

A FLYING TANK CAR is what they call the 2-stage, long-range missile, although Titan is its real name. It's built by the Martin Company (Denver). The reason for the name: Most of the airframe is tank; one for fuel; another for oxidizer.

The walls of the tanks are also the skin of the missile. The walls are curved, extruded panels stiffened with ribs running lengthwise. The panels are welded to form the tank cylinder. The tank domes are also weldments, but made from rolled plate. The material is copper-rich aluminum alloy 2014, strong and light.

TAPE-CONTROLLED MILLING

Panels come to Martin flat and semihard (T4 condition). They are not uniformly thick, so they must be machined. This is done on a large, magnetic tape-controlled milling machine, first on the flat side, then on the ribbed side, between the ribs.

HYDRAULIC STRETCH FORMING

A hydraulic stretch-forming press shapes the panels to the radius of the tank. The press is the largest of its kind, forming the panels over a Kirksite contour block with a 380-ton pull, while side-jaws keep the panels from going hour-glass shape. The press will stretch-form work as wide as 5 feet and as long as 24 feet. Then panels are age hardened to T6 condition.

CHEMICAL MILLING

The more metal they can take off the panel, the farther the missile flies. So Martin rids the panel of needless metal. It's done with chemical milling, an etching process that removes metal at a controlled rate. First, the panel must be vapor degreased, and rinsed, first in an alkaline bath, then in a deoxidizer. Now the panel is masked.

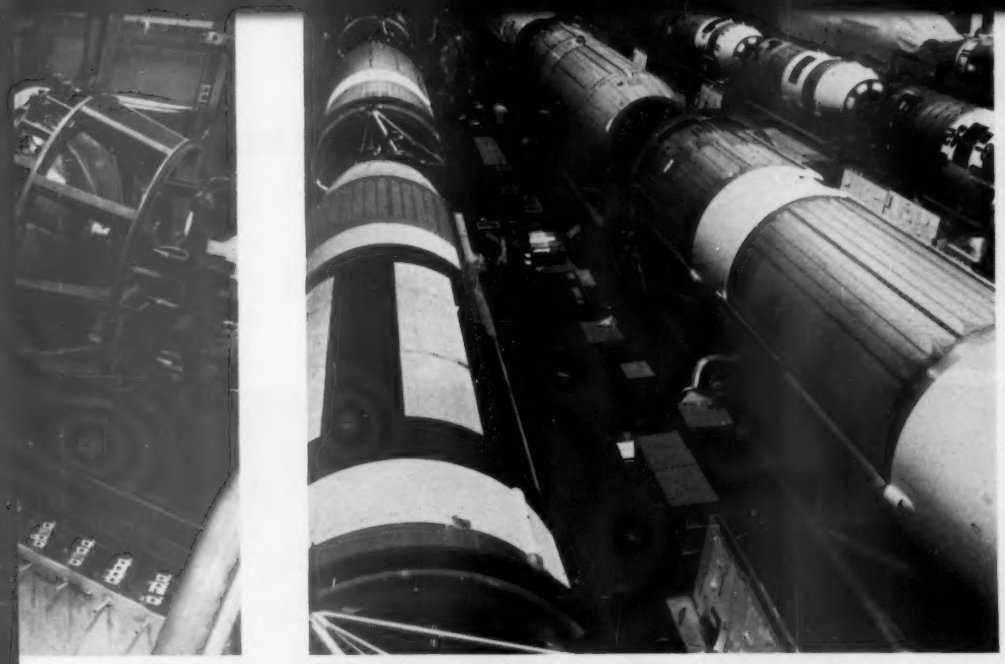
They coat the panel with a neoprene-base liquid and cure it at 225 F. Then the areas to be milled are exposed by stripping them of the masking film.

The etchant used in chemical milling removes metal at 0.001 ipm. When enough metal has been removed, part is rinsed, deoxidized, and masking stripped.

Martin likes these advantages of chemical milling over machine milling: Parts can be batched; formed parts can be milled; they can be tapered by gradual removal from the etchant.

WELDING TANK-BODIES, OR BARRELS

It takes 12 formed panels to make a tank body—section, or barrel. They are welded in 3-panel quarters first; then the quarters are joined. The welding is done in a fixture consisting of a bed, locating and clamping paddles, a welding bridge, welding head, and controls. Pneumatic clamps grip the ribs of the panels to hold



TWO STAGES OF MISSILE are shown in various phases of assembly. Completed first stage (background) is shrouded and ready for shipment. The second stage behind it is being prepared for shipment.

And Welding The Titan Missile

them in place. As the welding head traverses the bridge, clamps on the bridge butt the joint edges. When a seam between panels is welded the bridge clamps are released and the panels and paddles rotated to the next joint.

Four quarter-barrels are then clamped and girth welded into a complete barrel assembly. After welding, two electrical cutting heads trim the body ends.

Martin has found that the best way to join the copper-base aluminum alloy is with tungsten arc and aluminum filler wire. They have also found that to keep weld strength they must keep the heat-affected zone narrow. They do this by backing each side of the butt with an aluminum chill bar. And to keep the backup from welding to the panels, they insert an undercut strip of steel between backup and puddle.

WELDING THE DOMES

Next, the domes. Domes are made by welding 8 orange-peel segments of copper-aluminum alloy sheet. The segments are stretch-formed, rough trimmed, age-hardened, and chem-milled. Then they are cut to shape in a fixture with twin routing heads that move in the opposite directions.

The segments are put into a weld and trim fixture which has three major components: a variable-speed positioner, a tilt mechanism, and a welding-head boom. The fixture fits into the dome assembly and backs up the weld joints. This controls weld penetration.

Welding starts at the apex of the dome assembly, finishes at its base as the turntable tilts to keep the weld joint under the welding head. The table is returned to its original position and turned to bring the next joint under the welding head.

After the segments have been joined, the turntable is turned and they machine the base of the head with a built-in routing head preparatory to adding an extruded frame member to the base of the dome. They join it with circumferential welds made by tilting the turntable 90 degrees and rotating it under the head.

JOINING TANK BARRELS TO DOMES

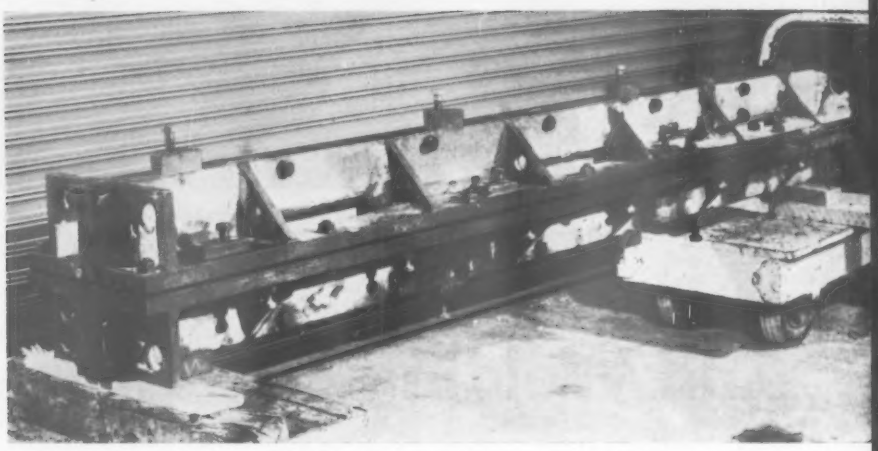
The tank barrel and two domes are welded on an automatic fixture. This machine has a bed, two rotary chucks, roller rings, and an automatic welding head. Two dome assemblies are clamped in the chucks and the barrel is positioned in the roller rings. The fixture segments roll together so that joint edges butt. The fixture turns and each circle weld is made in one continuous operation.

Testing follows assembly and welding. Missile tanks must not fail. All welds are examined closely and tested with penetrating dye. Barrel and dome welds are X-rayed for cracks, porosity, inclusions, and incomplete fusion.

Final work on the tank includes hydrostatic testing, cleaning, calibrating, protective coating, and drying. The last step is to purge the tank with nitrogen, then seal it. • •

the product . . .

the fixture . . .



FOUR THICK nodular iron angles bolt together to fixture control rods for production welding. The rigid fixture acts like a heat sink; parts come out straight and true.

How To Weld Boron Stainless Steel Without Cracks Or Distortion

by **JOSEPH POTOCHNIK,** *Nuclear Power Dept., Allis-Chalmers Mfg. Co., Milwaukee*

IN BRIEF: This company researched three ways to fabricate atomic power plant control rods from brittle, neutron-absorbing, boron-bearing stainless. Manual welding in a rigid fixture was the best way.

IT LOOKS AS IF we will make control rods of stainless steel for the atomic power plant at Sioux Falls, South Dakota. The metal will be ¼-inch-thick type 304, 2-percent boron, stainless steel. Boron stainless steel is ideal for atomic applications because it absorbs thermal neutrons. It is a 2-phase alloy composed of a complex boride phase in an austenitic chrome-nickel-iron matrix.

Boron stainless steel is notch-sensitive. Because it is, we remove scratches and other stress raisers and bend and form with generous radii.

DESIGN BACKGROUND

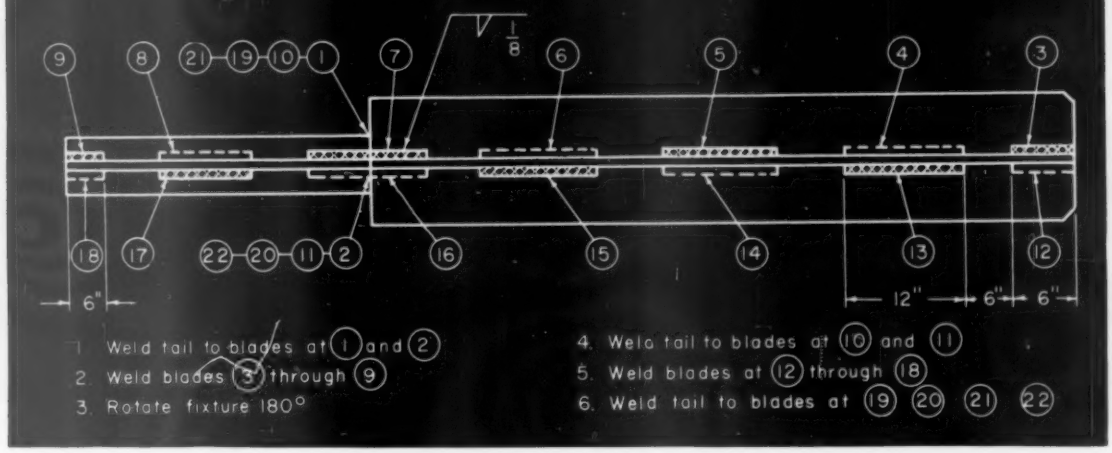
Control rods are used in the superheater and boiler section of the reactor. There, steam and water at 600 psi heat the rods to 500 F. Besides heat and pressure, the rods suffer wear, shock, and neutron bombardment.

In looking for a way to fabricate the brittle boron stainless steel, we experimented with three rod designs: 4-piece formed angle, 2-piece slotted, and 3-piece fusion welded.

The 4-piece design took bending. We found that we had to heat the plates to 1,750 F. before bending and keep the corner radius at least ⅜ inches to avoid cracking. Then we seam welded these angles

the weld . . .

the welding procedure . . . FOR PRODUCTION OF CONTROL RODS



to make the rod assembly, and reinforced it with spot welds. It was the most rigid and distortion-free of the three designs, but unfortunately, the most costly.

There was little choice between the slotted and welded designs in ease of fabrication or holding tolerances. What turned the tide in favor of the welded construction was better design.

WELDING TECHNIQUES

In a reactor, control rods are not highly stressed. Hence, small welds suffice. First we tried welding control rods with inert-gas metal-arc. We used 1/16-inch type ER-308 and ER-309 filler wires, but the fillets were too big. So we went to 0.045-inch wire. The filler size was just right with the smaller wire if welding speed were high enough. But at the right speed we got poor fusion at the toe of the fillet. Moreover, the combination of high heat and fast travel resulted in undercutting.

Next we tried manual welding with coated electrodes. We got the best results (in fillet size and quality) with 3/32-inch type E308-16 electrodes. Weld cross-sections were uniform and sound, just what we wanted.

How strong were the welded rods? Strong enough, said the tensile test . . . and they always failed in the base metal. And impact? The base metal strength was 4 to 5 ft.-lb. by Charpy test. Across the weld joint, the impact strength averaged 6 to 7 ft.-lb.

We set up for production welding of control rods by building a fixture. The fixture was rigid; it had four 2-inch-thick angles made of nodular iron. This rigidity, plus the brittleness of boron stainless steel, meant that our welding procedures had to equalize stresses. If it didn't, a few degrees of distortion, without heat, would overload and crack the rod. Our procedures (see sketch) prevented this. Another thing the heavy fixture did was draw welding heat from the rod. This helped limit distortion too.

We watch closely for cracks in control rod welds. After the rods cool, we inspect the welds with fluid penetrants. We inspect every weld in every rod. All have been sound and crack-free.

We use antispatter compound to reduce cleaning. And we don't grind the fillets; they're smooth enough as they are.

Our rods are safely within drawing tolerances; bow and twist in the 9-foot lengths are under 1/16 inch; angularity between blades within ¼ degree. Rigid fixture and fussy welding are responsible. • •

WELDED FIELD CONNECTIONS are made with E-7018 electrodes in downhand position. Connections on periphery of frame will absorb 300 kips wind loading.

Design Special Columns And Girders

IN BRIEF: Load-bearing box sections and special built-up girders are an important part of the new 20-story United Engineering Center.

THE WELDED STEEL SKELETON of the 20-story United Engineering Center, New York, is another step up in skyscraper construction. It is the second major welded structure completed this year in that city. The other, the 32-story Western Electric building, is one of the largest welded buildings in the U. S. (August, 1960, page 44).

The building will be the headquarters of 18 technical societies, which have a combined membership of over 300,000. One of them is the American Welding Society, so it seems fitting that the beams, columns, girders, and trusses are of welded design.

Our company was the steel contractor. We fabricated and erected 3,300 tons of structural steel using Lincoln Electric Company's AC transformers, coated electrodes, and semiautomatic submerged arc welding equipment. In our Long Island City, N. Y. shop we welded root passes and heavy sections with E-7018 electrodes. This electrode fills and freezes fast so it helped us keep welding costs down. Long, continuous joints were welded with submerged arc. We used E-7014 electrodes for the remaining shop welds.

In the field, we welded important, or heavy connections with E-7018 electrodes. Other out-of-position joints were made with 3/16-inch E-6013 electrodes. We used 7/32 and 1/4-inch E-7014 electrodes for non-critical downhand welding.

The building's shear and wind connections were designed for downhand field welding. Outside column-beam connections will absorb a wind load of 300 kips and remain rigid.

UNUSUAL BOX-SECTION DESIGN

The load-bearing box sections at the elevator shafts are of unusual design. These members are rigid, as high as the building, and are 8 by 17-3/4 inches in cross-section. The wider plates of the box are 1-3/4 inches thick; they fit between the narrow (8-inch

BOX-SECTION COLUMNS have root passes made with E-7018 electrodes. After root passes, grooves are filled by submerged arc. Square steel backup bars on inside are left in place.

ONE OF SEVEN special built-up girders, 41½ feet long and weighing 10 tons, is readied for shipment. Stiffeners are welded to web near cutout for utility lines.

For Welded Skyscraper

by **PHIL DRIER**, *chief engineer, Drier Structural Steel Co., Inc.*

wide) plates which are 1-1/2 inches thick. The wide plates are beveled for welding and each of the four joints of the box backed up with 3/8-inch square rods. We first put in a root pass with E-7018 electrodes, then filled the grooves by submerged arc. Submerged arc fills the deep grooves quickly and smoothly with little distortion.

TRUSSES HAVE SPECIAL BUILT-UP GIRDERS

Several 22-ton trusses span the 2-story reference library. Each truss consists of 14-inch wide-flange beams (weighing 111 to 370 lb. per foot) and seven special built-up girders (weighing 10 tons each). The girders are 41-1/2 feet long and have a 5/8-inch thick web plate, 40 inches deep. Flange plates at either end are 2 inches thick and almost 10 feet long. The center flange plates are 5 inches thick and 22 feet long. All flanges are 20 inches wide.

The girder has a 12- by 17-inch cutout in the web about 12 feet from one end, to pass ducts and conduit. The cutout is framed with 1-1/2-inch thick by 8-inch wide stiffener plates on both sides of the web. We welded them to the web with 1/2-inch fillets. All except the longest fillets are continuous. The longer welds are intermittent. This reduces heat and prevents warping. Four other stiffener plates 6 inches wide are welded on both sides of the web at the cutout end of the girder. These plates were joined with 5/16-inch fillets. Their inside corners are cut off to clear web-to-flange welds on the girder. The girders are also reinforced with 1/2- by 6-inch plates 8 feet long welded to the insides of the flanges on either side of the web at the center section. We welded these plates with 7/16-inch intermittent fillets.

Girder flange joints are double-beveled for welding. The 5-inch thick plate is beveled to the thickness of the 2-inch thick plate at the joint. At the joint, we made a 1-inch cutout for welding through the joint.

Web-to-flange welds are 3/8-inch intermittent fillets, except at the ends where flanges are thinner. This was necessary because the local building code does not permit a continuous 5/16-inch fillet, despite the fact that it would be strong enough, would cause less distortion, and would be cheaper. • •

55,000!

HIGH STANDARDS AND QUALITY ELECTRODES FEATURE CONSTRUCTION OF WORLD'S HIGHEST PRESSURE STEAM GENERATOR.

The Eddystone Station of the Philadelphia Electric Company is a milestone in power station engineering and operating efficiency.

Situated on the banks of the Delaware River south of Philadelphia, Eddystone is the first power station in the world designed to produce steam at the supercritical pressure of 5,000 pounds per sq. in. and a temperature of 1200° F. This breakthrough in the commercial generation of electricity is expected to set a new world's record for power station efficiency by producing a kilowatt hour from 2/3 pound of coal.

55,000 welds were used to fabricate the hundreds of miles of tubing and piping used in the construction of the steam generating unit. Approximately 25,000 of these were field welds made at the construction site. The extreme operating pressure and temperature necessarily required unusually high weld metal quality and reliability from the electrodes selected. For the field welds, Combustion Engineering, designer and manufacturer of Eddystone's No. 1 boiler, specified Arcaloy types 316 and 347 stainless steel electrodes for the chromium-nickel material, Atom·Arc 8018CM and 9018CM iron powder low hydrogen electrodes for the chrome-moly grades and Atom·Arc 7018Mo for the carbon-moly grades. Continuous visual inspection was conducted as all welding proceeded. Dye penetrant and X-ray inspection of welds were used throughout the erection of the boiler. When the boiler had been completely welded, it was hydrostatically tested at 8,000 psi. pressure. All of these tests and inspections failed to show one defective or leaking field weld.

These dynamic results mirror the experiences of many leading fabricators throughout the country. Like Combustion Engineering, they have proven conclusively that X-ray quality weld metal of Alloy Rods Company electrodes increases the efficiency of their welding operations. They have learned from experience—you can profit from their experience. Specifying your electrode requirements from our extensive line of quality alloy arc welding electrodes is the one sure guarantee of satisfaction. Alloy Rods Company, York 1, Pennsylvania.

The steam producing heart of the station is a C-E Sulzer Monotube Steam Generator, designed and manufactured by Combustion Engineering. This unit is 12 stories high, 100 feet across, and 75 feet from front to back. 170 miles of all-welded tubing and piping, low-chromium and chromium-nickel material, went into the unit's fabrication.

WELDED JOINTS HYDROSTATICALLY SOUND

ALLOY RODS COMPANY

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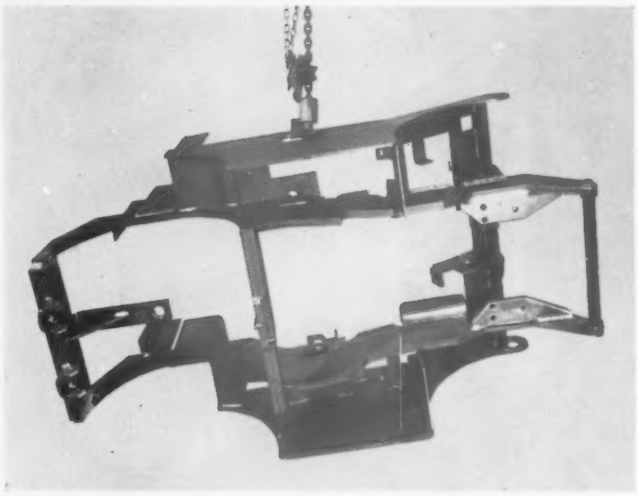
the work . . .

the weldment . . .



Towmotor Corporation fabricates this fork lift truck frame from flame cut parts

Why Towmotor Flame Cuts Automatically With Low Pressure Natural Gas

by **J. G. MILLIGAN,** *general foreman-weld shop, Towmotor Corp., Cleveland*

IN BRIEF: This manufacturer of materials handling equipment made a thorough investigation before switching to low pressure natural gas for automatic flame cutting.

OUR MANAGEMENT HEARD many reports on the benefits of automatic flame cutting with low pressure natural gas. We investigated it for cutting parts for the materials handling equipment our company makes. Then we made the change with help from the Harris Calorific Company.

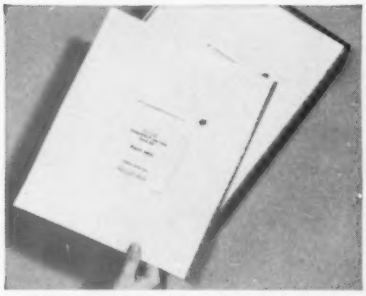
The change was made in two steps: First, we installed natural gas cutting tips on the machine cutting torches we were using. (We piped the natural gas through our acetylene lines and added gas booster pumps to get pressures high enough for good cutting.)

The results were good. The gas savings alone more than paid for the parts and labor.

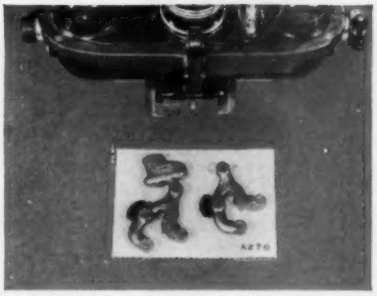
We were led to the second step when we realized that if we were saving 10 to 15 percent just by using special tips and natural gas, then torches designed for natural gas cutting would give us more savings, particularly in the oxygen needed for preheating.

We tested different machine cutting torches under actual operating conditions. We measured gas consumption with a flowmeter and judged cutting speed and cleanliness of cut. The torches we picked gave the best balance between cutting speed and fuel economy.

The new machine cutting torches and tips saved us enough preheat oxygen to pay for them in a few months. We got other benefits. These include clean cuts (there is little slag and we do little grinding) and less metal hardening because of carbonization. • •



1) No darkroom loading. Ready for exposure as it comes from the box.



2) Just place in position and expose —the film is protected from dust, dirt, light and moisture.

3) In the darkroom, pull the rip strip, remove film, and process.

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Kodak Industrial X-ray Film

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the part . .

Most of the welds in this stainless steel exhaust for a J-47 jet engine had to be removed before 10,000 exhaust nozzles could be reworked

the work . .

STAINLESS STEEL WELDS on support plates are removed using 200 amps DC reverse polarity and compressed air at 90 psi. Once welds are removed, the inside tube is easily withdrawn.

Arc Gouging Stainless Steel Welds Cuts Rework Time 93 Percent

Why stainless for jet engines?

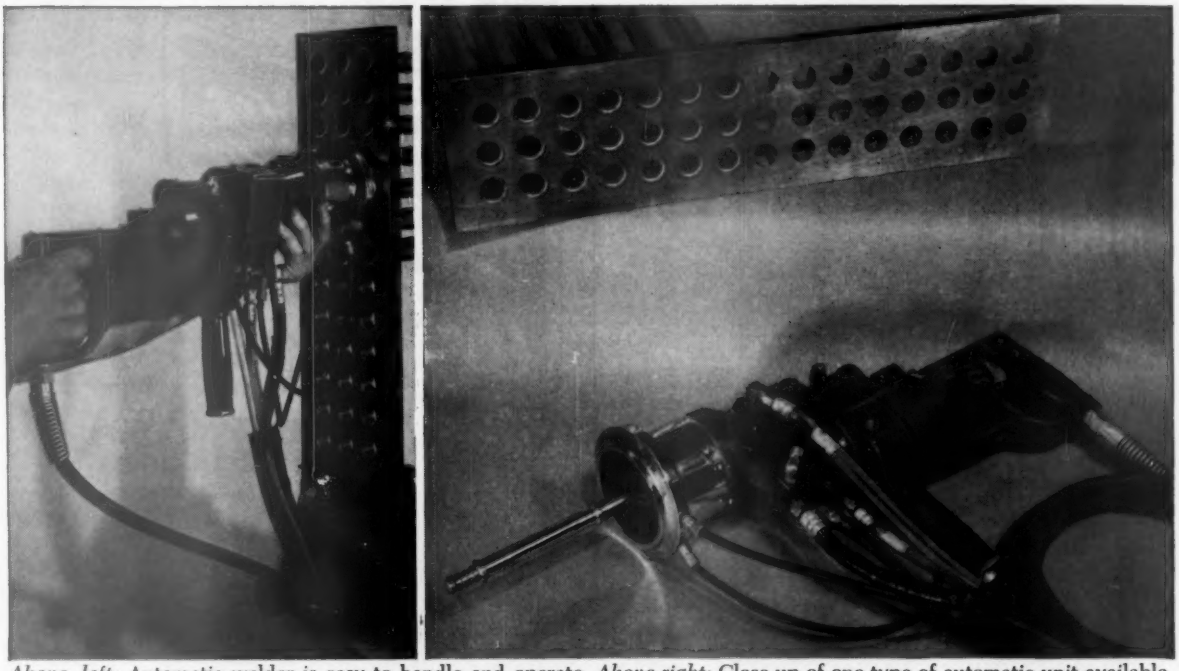
The jet engine heats metal to an average of 1500°F. for extended periods. The designers specified type 321 and type 347 stainless steels for all exhaust parts, including weld metal. Besides resisting high temperatures, these alloys have excellent strength-to-weight ratios and high corrosion resistance.

Type 321 contains titanium in amounts of five or more times the carbon content. Type 347 contains columbium (plus tantalum) in amounts 10 times the carbon content. Both these elements have a greater affinity for carbon than does chromium. In the heat of welding and of jet engine operation, titanium or columbium carbides form instead of chromium carbides. The chromium remains in solid solution to provide corrosion and heat resistance.

IN BRIEF: Carbon-arc compressed-air gouging speedily removes weld metal without damaging stainless steel jet engine exhaust nozzles.

IT LOOKED FOR A WHILE as if the hard-to-remove exhaust nozzles of J-47 jet engines would have to be replaced completely. These engines power such Air Force planes as the F-86 Sabrejet and the B-47 Bomber. The exhaust nozzles consist mainly of a 0.045-inch-thick outer cone and 0.062-inch-thick inner cone, both of stainless steel. The two cones are joined by four streamlined tubular struts welded to supporting plates along the side.

Originally the exhaust from the J-47 engine created a high vacuum when it passed by the inner cone. After a time, hairline fatigue cracks developed in the inner cone because of stress and the onset of fatigue. The engineers discovered they could equalize pressure and



Above, left: Automatic welder is easy to handle and operate. *Above right:* Close-up of one type of automatic unit available for welding tubes to tube sheets. Note uniformity of sample welds above.

Mechanized welding process makes the permanently tight heat exchanger tube joints needed in modern power plants

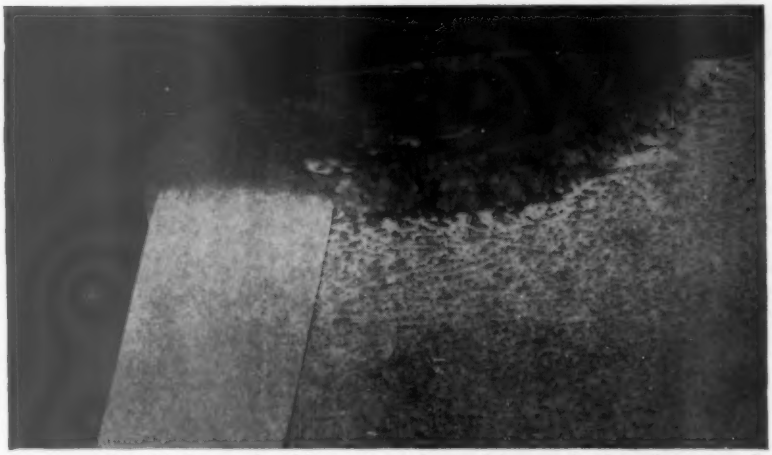
The design and operation of modern steam power plants require that tubes in condensers and feed-water heaters be installed permanently tight to prevent contamination of the boiler water.

Welding the tubes to the tube sheets will insure this. In most cases, however, welding cannot be done manually for a variety of reasons. A mechanized process must be employed to produce consistently high quality joints.

Inert-gas tungsten-arc (TIG) welding has the advantages of simplicity, good control, and protective shielding without the use of flux. Tough, dependable equipment for automatic welding with this process—such as that shown in the illustrations above—is widely available. These units make it possible to weld, without the complication of filler-metal addition, most of the tube and tube sheet combinations employed in condensers and heat exchangers.

Joints, whether a few hundred or several thousand in number, are uniform in geometry and quality. Typical are the results obtained with tubes of Arsenical Admiralty-439 on tube sheets of Naval Brass-450, as shown in the 20X micrograph reproduced at the left, below.

Technical Assistance: The Metallurgical Department of The American Brass Company will gladly help you in the selection of suitable alloys and in welding procedures and the design of joints. This service is available without obligation. See your American Brass representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.



Micrograph 20X of typical weld section. Tube is of Arsenical Admiralty-439 and tube sheet is of Naval Brass-450.

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minimize fatigue by drilling holes in the deflector of the inner cone. To drill these holes, however, each inner cone had to be dismantled from its nozzle.

Carson Machine & Supply Co., Oklahoma City, contracted to modify 10,000 nozzles. During rework of the first 700, they ran into serious trouble. They bid on the basis of only one test modification job. In this test they removed the inner cone by grinding down the stainless steel welds along the retainer sections and the side support plates. They used a 13,000-rpm grinding wheel. When they started the production job, they found they needed too many grinding wheels to remove the welds.

One alternative was to use a carbon arc-compressed air gouging torch made by Arcair Co., Lancaster, Ohio. Carson stopped grinding and began arc melting the welds. Rework time dropped 93 percent a unit. Material cost ran 89 percent less. The contract was completed well ahead of schedule.

USING THE ARC GOUGING TORCH

The operator first grounds the work to complete an electrical circuit. He strikes an electric arc with a carbon electrode held in the torch, and weld metal close to the arc is melted. A jet of compressed air blown behind the electrode and parallel to it, spews the melted metal away. The process is mechanical and does not rely on oxidation, so it is effective on stainless steel.

Carson used a 200-ampere rectifier with 200-ampere reverse polarity current. Air was from the shop supply at 80 and 100 psi. A 3/16-inch copperclad carbon electrode was used with the torch.

Despite having been welded, having had the welds removed, and then being rewelded, the type 321 and 347 stainless steels retained the properties that led to their original selection. Carbide precipitation at the weld areas was so slight it could be ignored. Field inspections verified that the modified J-47 exhausts are performing well with no cracking. • •

NEXT MONTH: Arc gouging and cutting will be one of the subjects covered in a special report on the metal cutting processes. Flame cutting and gouging, mechanical cutting, and pipe beveling and cutting will be discussed in detail.

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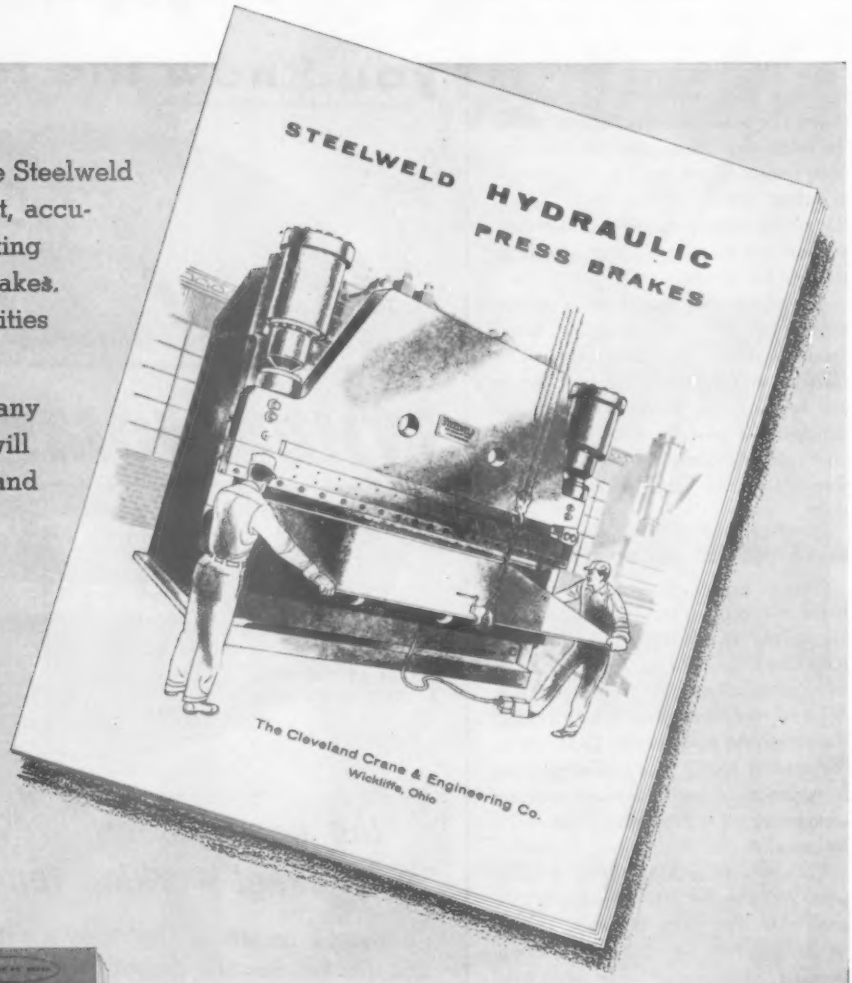

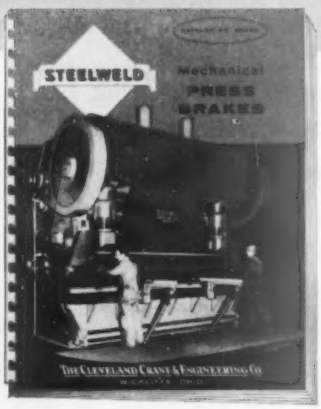

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SPECIAL REPORT

TURNABOUT is fair play; bending brakes often cut metal. This shear not only cuts, it bends up the sheet edge for welding at North American Aviation, Inc.

The Metal Fabricating Processes

. . . a two-part report on the equipment used to prepare metals for welding, and factors to consider in using this equipment

PART I Shearing And Forming

SHEARING, forming, and bending are as essential to welding as filler metals, welding current, and gases. Every piece welded to another must first be cut, quickly, accurately, and economically, to the right size and shape. And often it must be bent or formed.

Welding fabricators shear immense amounts of plate. The plate sizes, thicknesses, and composition you work with establish the size of the shear you need. Shears come in sizes that will match your requirements. The most common shears are: squaring, bar and angle, flying, hand, rotary, scrap, and alligator. Shears are also built to cut special shapes, or to fit into automated production lines.

Squaring shears cut more metal than other shears because they lop off the most metal with one stroke. They are either mechanically or hydraulically powered, come in capacities for cutting light-gauge sheet or heavy 2-inch-thick plate.

In buying shears (see Shearing Equipment Buyers' Guide, page 59) select the size and type that suits your work, and the work you expect to get. Pick a machine not only for its capacity, but for durability and ease of maintenance.

Effective and economical shearing demands adequate handling equipment to feed the shears and to handle the parts and scrap after shearing.

In fabrication, cutting and bending go together. But astute designers don't let a shear replace forming equipment like press brakes and stretch formers. They know that most sheared plate edges wind up as welding seams. So, wherever possible, they bend to avoid an extra weld. The result: lower costs and better looks.

Bending and forming aren't always a matter of choice; they're often demanded by the shape of the product. For example: tank shells, wire, angle, and bar products. For these jobs there are rolling and bending machines in many sizes.

The commonest bending and forming machines (see Bending and Forming Equipment Buyer's Guide, page 63) are press brakes, bending brakes, plate and angle rolls, hand benders, pipe, tube and bar benders, stretch formers, tangent, and wire and strip benders.

Press brakes bend more metal than other types. They are mechanically or hydraulically powered, come in many sizes. Mechanical presses are preferred for high production work. Hydraulic presses for accuracy, better control, and durability. The mechanical press can be overloaded, hydraulic presses can't.

SHEARING: An important step in shaping a product

The way carbon steels shear is usually used as the reference point for the way other metals shear. In comparing the shearing capacities of various metals (see table, page 60) the mild steel rating of the machine is given as the norm, and the other metals are compared with it.

Carbon steels can be sheared with any standard shearing equipment. Shearing is affected by the type and thickness of the metal, type of knife blade, adjustment and sharpness of the blades, size of cut, and the relation of the width of the cut to the sheet or plate thickness.

In squaring plates and sheets, it's a good idea to shear from one side only; this puts all of the burrs on the opposite side and doesn't complicate bending.

Metal with locked-up stresses is difficult to shear accurately. After cutting, these stresses are relieved through distortion of the metals. Where stressed metal must be used, it's best to try an oversize cut first and then make a second narrow trim.

The trend in shearing equipment, which includes bar and angle shears, flying shears, hand shears, and rotary slitters, is higher production, greater accuracy in cutting, and greater safety to operators.

THINGS YOU SHOULD KNOW ABOUT SHEARING . . .

. . . THESE METALS

ALUMINUM

Shear aluminum alloys up to ½-inch thick; saw or rout thicker materials. Aluminum takes deep shear knife penetration and absorbs greater energy in shearing than mild steel. Use less blade clearance with aluminum than with steel because of drag.

COPPER

Copper, like aluminum, takes more energy, less force to shear than steel. The shear blade has to penetrate copper almost all the way through; steel requires only a fractional penetration. It fractures through the rest of the gage. Use less shear blade clearance with copper than steel.

MAGNESIUM

If you get rough, flaky edges when you shear magnesium sheet thicker than 0.065 inches, reduce blade clearance to under 5 percent of the metal thickness. The rake angle of the upper shear blade should be between 30 and 45 degrees. Heavy sheet and plate (annealed) should be heated to 600 F before shearing; hot rolled stock between 275 and 400 F.

MOLYBDENUM

Warm molybdenum sheet over 0.020 inch thick before shearing. Increase preheat temperatures as the metal thicknesses increase. Warm blades before shearing; keep them sharp to avoid laminating and cracking the sheet. Don't shear 0.050-inch sheet and thicker to size; shear it slightly oversize, then edge machine.

NICKEL

It takes more power to shear high nickel alloy sheets and plate than it does to shear mild steel of the same thickness. Keep shear blades tight and sharp.

HIGH STRENGTH STEEL

These steels require heavier, more secure clamping during shearing than the carbon steels. You'll need about 20 percent more force.

CLAD STEEL

Shear with the clad side up. The burr forms on the steel side. Where welding follows shearing, take shear droop, resulting from blade pressure, in consideration.

STAINLESS STEEL

It takes 30 to 50 percent more power to shear stainless steel than it does carbon steel. Use high-speed or tool steel shear knives with a 2 degree lip rake. Sharp, snug blades prevent metal drag.

Ferritic and martensitic grades shear like carbon steel; they break when cut a little more than half way through. Use the clearances you use with carbon steels.

Cut the austenitic grades all the way through. Set clearance 1/20 the thickness of the metal, up to 0.003 inches. Protect stainless against marring, and use non-metallic hold-down tips on the shear.

TITANIUM

Titanium shears something like stainless. For best results in subsequent forming, remove burrs from the blank edge. Titanium is so notch sensitive, deburring should result in a round, smooth edge.

TUNGSTEN

Shear tungsten hot. Keep dies and shear blades sharp to avoid laminating and cracking the tungsten. Don't shear sheet 0.050 inch and thicker to size. Allow to ⅛ inch and edge grind to size. Hot work steel dies do a fairly good job on tungsten.

SHEARING EQUIPMENT *Buyer's Guide*

MACHINE BUILDER	SQUARING SHEARS	BAR & ANGLE SHEARS	FLYING SHEARS	HAND SHEARS	ROTARY SHEARS	SCRAP & ALLIGATOR SHEARS
Abbey Etna Machine Co. Perrysburg, Ohio			●		●	
Armstrong-Blum Mfg. Co. Chicago				●		
Berkroy Products, Inc. Los Angeles		●				
Buffalo Forge Co. Buffalo, N. Y.		●				
Cincinnati Shaper Co. Cincinnati, Ohio	●					
Cleveland Crane & Engineering Co. Wickliffe, Ohio	●					
Dahlstrom Machine Works Chicago	●		●			●
Edwards Mfg. Co. Albert Lea, Minn.		●		●		●
Famco Machine Co. Kenosha, Wis.	●					
Hill-Acme Co. Cleveland		●			●	●
T. H. Lewthwaite Machine Co. New York, N. Y.		●		●		
Niagara Machine & Tool Wks. Buffalo, N. Y.	●			●	●	
O'Neil-Irwin Mfg. Co. Lake City, Minn.	●			●		
Pacific Industrial Mfg. Co. Oakland, Calif.	●					
Peck, Stow & Wilcox Southington, Conn.	●			●	●	
H. K. Porter, Inc. Somerville, Mass.		●		●		
Rotex Punch Co., Inc. San Leandro, Calif.				●		
Shearease Company Torrance, Calif.		●				
Thomas Machine Mfg. Co. Pittsburgh, Pa.	●	●				
Verson Allsteel Press Co. Chicago	●	●				
Whitney Metal Tool Co. Rockford, Ill.	●	●		●	●	
Williams-White Co. Moline, Ill.		●				

DON'T OVERLOOK THESE COMPANIES . . . .

We couldn't fit all of the machines and components used in shearing and forming into the buyer's guides (on this page and on page 60). Here are some of them that are used extensively in welded fabrication:

AMERICAN PULLMAX CO., INC., Chicago: Universal shearing and forming machines.
**ACF INDUSTRIES, INC., Riverdale, Md.: Shrinking, stretching, forming, flanging machines.
*BUFFALO FORGE CO., Buffalo, N. Y.: Billet shears
BEVERLY SHEAR MFG. CO., Chicago: Throatless shears, slotters, fitters.
*CINCINNATI SHAPER CO., Cincinnati, O.: High speed coil line shears.
**CURVIT DIV., MACLODYNE CORP., East Providence, R. I.: Pipe and tube coilers.
* **DAHLSTROM MACHINE WKS., Chicago: Roll formers.
*EDWARDS MFG. CO., Albert Lea, Minn.: Cable cutters.
*HUFFORD DIV., SIEGLER CORP., El Segundo, Calif.: Spin forge power shear forming.
**HILL-ACME CO., Cleveland: Billet shears.
GEO. C. PATTERSON MACH. CORP., Cleveland: Wire straightening, bending, cutting.
**R. E. SMITH CO., Waukegan, Ill.: Cleat benders.
SIMONDS SAW & STEEL CO., Fitchburg, Mass.: Blades for shears and slitters.
*VOGEL TOOL & DIE CORP., Melrose Park, Ill.: Notching tools, tube and pipe cutoff dies.
* **WILLIAMS-WHITE CO., Moline, Ill.: Billet shears, bulldozers.
WALES-STRIPPIT INC., Akron, N. Y.: Punching and notching equipment.

*See Buyer's Guide (above) for shears manufactured by this company.
**See Buyer's Guide (page 63) for bending and forming equipment made by this company.

SHEARING CAPACITIES OF VARIOUS METALS

NORMAL MILD STEEL RATING OF MACHINE		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
ALUMINUM		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
ALCLAD		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
BRASS 70% CU. 30% ZN.		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
COPPER		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
CUPRONICKEL 70% CU. 30% NI.		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
DURALUMIN, COLD ROLLED		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
MONEL		14 GA	10 GA	3/16	1/4	3/8	7/16	1/2	3/4	7/8
SILICON STEEL		5/64	1/8	5/32	1/4	5/16	13/32	1/2	21/32	13/16
STAINLESS 18/8 ANNEALED		14 GA	1/8	3/16	1/4	3/8	7/16	1/2	3/4	7/8
HIGH CARBON 40 - 50 CARBON 200 BRINELL		14 GA	1/8	3/16	1/4	3/8	7/16	1/2	3/4	7/8
ZINC, ROLLED SHEETS		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
U.S. CORTEN		14 GA	10 GA	3/16	1/4	3/8	7/16	1/2	3/4	7/8
U.S. MANTEN		14 GA	10 GA	3/16	1/4	3/8	7/16	1/2	3/4	7/8
U.S. AR. ABRASION RESISTANT FULL HARD		14 GA	10 GA	3/16	1/4	3/8	7/16	1/2	3/4	7/8
MED. HARD		14 GA	10 GA	3/16	5/16	7/16	1/2	5/8	7/8	1"
HI STEEL		14 GA	3/16	3/16	5/16	7/16	1/2	5/8	7/8	1"
STAINLESS CLAD 20 %		14 GA	10 GA	3/16	5/16	7/16	1/2	5/8	7/8	1"
SILICON BRONZE		10 GA	3/16	1/4	3/8	1/2	5/8	3/4	1"	1 1/4"
STRIP STEEL	DEAD SOFT	10 GA	3/16	1/4						
	HALF HARD	10 GA	3/16	1/4						
	FULL HARD	3/32	1/8	3/16						
AIRCRAFT, NORMALIZED 4130		14 GA	10 GA	3/16	1/4	3/8	7/16	1/2	3/4	7/8
AIRCRAFT, NORMALIZED 8630		5/64	1/8	5/32	1/4	5/16	13/32	1/2	21/32	13/16
U.S.S. T1		14 GA	1/8	3/16	1/4	3/8	7/16	1/2	3/4	7/8
YOLOY 80 ROCKWELL B		14 GA	10 GA	3/16	5/16	3/8	7/16	5/8	3/4	7/8
INCONEL		14 GA	10 GA	3/16	1/4	3/8	7/16	1/2	3/4	7/8
ALUMINUM BRONZE		10 GA	10 GA	1/4	3/8	1/2	5/8	3/4	1"	7/8

BENDING AND FORMING add design versatility

Most metals can be bent or formed. Carbon steel, easily worked in standard equipment, is usually the reference point for working other metals. There are differences: Some metals don't have carbon's ductility; others work harden faster; still others are more sensitive to surface imperfections. Once you learn to work carbon steel—and it isn't hard—you simply adjust for the differences of the other metals to get good shapes repeatedly.

The simplest, most widely used method of forming steel is bending. Press brakes are the standard tool for this the world over. And besides bending, they corrugate, punch, draw, bead, straighten, cope, and seam. A standard press and interchangeable tooling is all you need.

You're fabricating a steel tank. You could make the shell by bumping the blank on a press brake. But the best and fastest way is on plate bending rolls. Bending rolls make perfect cylinders, without telltale marks.

If you want stiffeners, chances are you'll form angles or bar on rolls built for that job. The more bending and forming you do the less welding distortion and shrinkage you'll have. This is as true of the other metals as it is for steel. You may find it cheaper to use wiper, or stretch forming equipment. Wiper forming will give you different radii in one plane; stretch forming can give you compound curves.

Remember these things in bending and forming steel; The forming capacities of press brakes are based on air bends with a V die opening eight times the plate thickness. If your plate is over ½-inch thick, allow more than eight times its thickness to avoid fractures. Bend across the direction of rolling and with the shear burr up. Be sure .35 carbon plate is annealed before bending. Don't bend plate at less than room temperature.

THINGS YOU SHOULD KNOW ABOUT BENDING AND FORMING . . .

. . . THESE METALS

ALUMINUM

Allow for springback in bending high yield strength alloys and tempers. Use larger bend radii on the alloys than you do on pure aluminum. For severe forming of alloys 1100, 3003, and 5052 start with the soft tempers. These alloys harden with cold working. The most difficult temper to form is the fully aged (T6) condition.

COPPER

Take these factors into account when bending or forming copper: gage, temper, bend radii, and whether the bend is across or with the direction of rolling. They control how much forming or bending you can do. Allow for springback by overbending.

MAGNESIUM

Form magnesium hot except for slight, large-radius bends. Form it slowly to avoid cracks. Form annealed and hard-rolled magnesium either hot or at room temperature. For room temperature forming, use large radii with open, rectangular dies, smaller radii with 90 degree dies.

MOLYBDENUM

Never form moly cold. Form 0.020-inch-thick sheet and under at room temperature. Bend D sheet, 0.020 inch and under, 180 degrees in any direction on a radius equal to its thickness. Warm 0.020 to 0.040 moly between 200 and 325 F. Bend sheet thicker than 0.040 at 1,000 F to avoid cracks.

NICKEL

Form and bend nickel the way you do steel, except you'll need more power for the high nickel alloys. The high nickel alloys must be annealed more frequently than steel during cold working.

CLAD STEEL

Anneal clad steels before forming or bending them. Since clad steels spring back, use large radii and overbend slightly. Bend and roll heavy gage metal hot when low alloy steel backing is used. Make allowances in bending and forming the straight-chrome clad steels; they aren't as ductile. Clean plate and equipment before rolling or bending to avoid imbedding scale and chips in the metal which might become corrosion starters.

HIGH STRENGTH STEEL

Use greater force to form and bend the thick alloys than you would use on carbon steel. Use liberal bend radii, slightly increased die clearances, and allow for more springback than with carbon steel. Hot form thick sections between 1,550 and 1,650 F, but not below 1,200 F.

STAINLESS STEEL

The stronger, harder stainless steels need more forming force than the carbon steels. The austenitic grades work harden twice as fast as carbon steel, might have to be annealed between formings. The springback of stainless steel is double that of carbon steel; overbend it to offset springback. Keep the bend stroke short to reduce scoring. Contour stainless by roll bending or stretch forming.

TITANIUM

Brake form commercially pure titanium with a radius at least 3 times the metal thickness. Heat the metal between 400 and 600 F for brake forming. The springback of titanium is equivalent to that of quarter-hard 18-8 stainless steel. Polish blank edges before bending to remove notches. Form titanium hot to avoid springback.

TUNGSTEN

Form 0.010 inch sheet and wire at 200 F, 0.015 inch, between 400 and 500 F, 0.015 to 0.040 inch at 1,000 F, and thicker metal as high as 3,000 F. Heat prevents fracture. Keep radii at least twice the material thickness.

*$100.00 per part production SAVINGS.....

...with the BATH METHOD

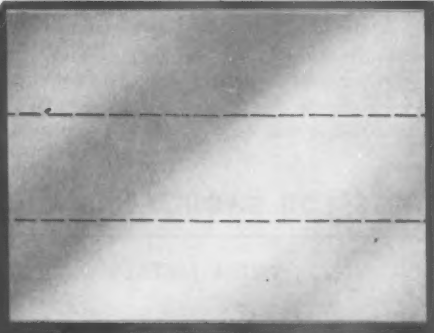
OLD METHOD

Cutting out the blank in this titanium piece was not only tough, but material waste is evident.

Drop Hammer operation resulted in heavy scrap loss.

Finished part

BATH METHOD



3 titanium parts per piece instead of one.

Radial Draw Forming prior to Drop Hammer operation eliminated metal distortion, greatly reduced rejects.

Finished part

*The illustrated titanium part was not only expensive to make by old methods, but because of metal distortion, the part reject loss was tremendous. By STRETCH RELIEVING the titanium, using a Bath Radial Draw Former, part rejects were practically eliminated . . . in short, a method of forming shapes that keep their shape . . . even after heat treating . . . *Send for the plant facilities folder, it illustrates both the standard Radial Draw Forming facilities, plus a completely new series of production forming machines.*

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Press Brakes • Tangent Bending Sequence Presses • Press Type Brakes • Special Machines

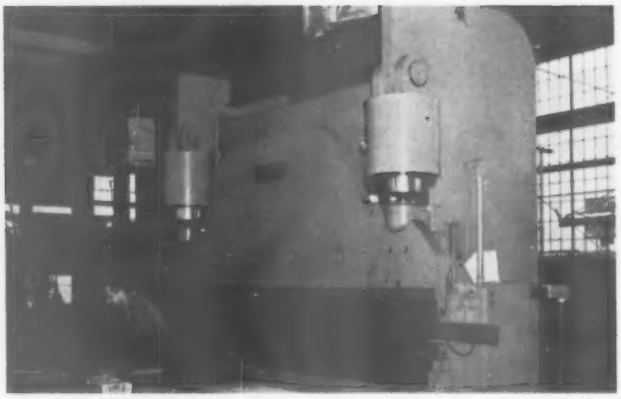
For More Information Circle No. 28 on Reader Service Card.

BENDING & FORMING EQUIPMENT *Buyer's Guide*

MACHINE BUILDER LOCATION	BENDING BRAKES	PRESS BRAKES	PLATE & ANGLE ROLLS	HAND BENDERS	PIPE, TUBE & BAR BENDERS	STRETCH FORMERS	TANGENT BENDERS	WIRE & STRIP FORMERS
Abbey Etna Machine Co. Perrysburg, Ohio					●			
ACF Industries, Inc., Riverdale, Md.						●		
Berkroy Products, Inc. Los Angeles	●		●					
Buffalo Forge Co. Buffalo, N. Y.			●					
Cincinnati Shaper Co. Cincinnati, Ohio		●						
Cleveland Crane & Engrg. Co. Wickliffe, Ohio		●						
Curvit Div., Maclodyne Corp. East Providence, R. I.				●	●			●
Cyril Bath Company Solon, Ohio	●	●				●	●	
Dahlstrom Machine Works Chicago					●			
Dries & Krump Mfg. Co. Chicago	●	●					●	
Excelsior Tool & Machine Co. East St. Louis, Ill.		●	●					
Federal Machine & Welder Co. Warren, Ohio		●						
Hossfeld Mfg. Co. Winona, Minn.				●	●			
Hufford Div., Siegler Corp. El Segundo, Calif.						●		
Kling Bros. Engrg. Wks. Chicago					●			
Leonard Precision Prods. Co. Santa Ana, Calif.					●			
T. H. Lewthwaite Mach. Co. New York, N. Y.				●				
Lodge & Shipley Co. Cincinnati	●	●						
McKay Machine Co. Youngstown					●			
Niagara Machine & Tool Wks., Buffalo	●	●	●	●				
A. H. Nilson Machine Co. Shelton, Conn.								●
O'Neil-Irwin Mfg. Co. Lake City, Minn.	●	●		●	●			
Pacific Industrial Mfg. Co. Oakland, Calif.	●	●				●		
Peck, Stow & Wilcox Southington, Conn.	●				●			
J. A. Richards Co. Kalamazoo, Mich.				●	●	●		●
Rotex Punch Co., Inc. San Leandro, Calif.	●	●						
R. E. Smith Company Waukegan, Ill.	●							
W. Whitney Stueck Inc. Old Saybrook, Conn.	●	●		●				
Struthers-Wells Corp. Warren, Pa.	●	●					●	
Taylor-Winfield Corp. Warren, Ohio		●			●	●	●	
Thomas Machine Mfg. Co. Pittsburgh, Pa.			●					
Verson Allsteel Press Co. Chicago		●						
Vogel Tool & Die Corp. Melrose Park, Ill.					●			
Wallace Supplies Mfg. Co. Chicago			●	●	●			
Whitney Metal Tool Co. Rockford, Ill.	●	●						
Williams-White Co. Moline, Ill.					●			
K. R. Wilson Co., Inc. Arcade, N. Y.				●	●			

Note: See page 59 for manufacturers of other bending and forming equipment.

How would you buy a press brake?



YOU WOULD CONSIDER your production the cost, complexity, and workmanship of several press brake makes just as Steel Fabricators did. They bought a much larger press than they first intended, but it turned out to be the right one for their varied and heavy fabrication.

What prompts welding fabricators to buy shearing and forming equipment? Many things. Replace worn equipment, plant expansion, to gain a better competitive position, a new product. Here's how it was with Steel Fabricators Company, Cleveland, who recently bought a 600-ton hydraulic press brake.

WANTED A SMALL PRESS

"We didn't intend to buy a 600-ton press at all," Richard Pocker, vice president and plant manager of the company admitted. 'We had in mind a small, high production, highly accurate machine, but we're glad we bought the big one. It's accurate, fits our production, gives us capacity to spare, and we can maintain it without a bit of trouble.

"Furthermore," said Pocker, "The new machine does more than the small one we had considered: It bends light and heavy material, wide and narrow, and we use it for punching holes with our interchangeable tooling." Steelfab's new press brake bends 3-inch-thick plate in narrow widths, 1-inch plate in 9-foot widths, and 16-foot-wide plate in thinner metal.

Don't get us wrong. Steelfab's decision shouldn't influence you to buy a big press brake if you need a small one. Not at all. Buy the machine that fills your production needs. And that's exactly what Steelfab wound up doing. The light press would not have been right for their heavy plate fabrications: machine bases, pressure vessels, car dumping rings. And they had other reasons for buying the big brake:

IT TAKES TIME TO REBUILD

Pocker explained: "We had a 750-ton mechanical press brake that needed rebuilding. It could be rebuilt for two-thirds the cost of our new press. But this would have left us without a press for a long time. We couldn't wait.

"The mechanical press had been overloaded; it would no longer make accurate bends. This won't happen with our new press; you can't overload it. Our new press has a 12-inch stroke that can be set at anything up to that. This speeds bending and enables us to do jobs we couldn't do on the 4-inch stroke (fixed) mechanical press. Another thing, even though our new hydraulic is rated at 600 tons, it will bend thicker material than the 750-ton mechanical press. The reason: the mechanical press is rated at the bottom of its stroke while the hydraulic rating is true at any point in the stroke.

WORKMANSHIP AND MAINTENANCE IMPORTANT

"We investigated before buying the hydraulic," said Pocker. We ruled out the cheapest one because we noticed poor workmanship in several small details. It made us suspicious of the more important parts of the press. We ruled out another press because it cost too much. We liked the simplicity and the ease of maintenance of the hydraulic system of the press we chose.

"We intend to have our mechanical press trued up," Pocker went on. "When we do, we'll be able to bend a lot of work we might otherwise have turned away."

Pocker stressed the economy of buying press brake dies from press and blade manufacturers rather than from local tool and die shops. "It can save you a lot of money," he said. "For example, one manufacturer chopped the job shop's price in half. The pressmaker induction hardens inexpensive steel; the job shop would have used expensive, fully heat treated tool steel."

Pocker's advice on bending dies holds true for shearing knives and other fabrication tooling. It's better and cheaper to buy from quantity producing pros. The right knife will cut more, cleaner, cheaper.

Steelfab's shop is also equipped with a 10-foot plate shear, heavy-duty bending rolls, and angle-bending rolls.

you can use this press brake data ⟩

TONNAGES REQUIRED FOR BENDING MILD STEEL

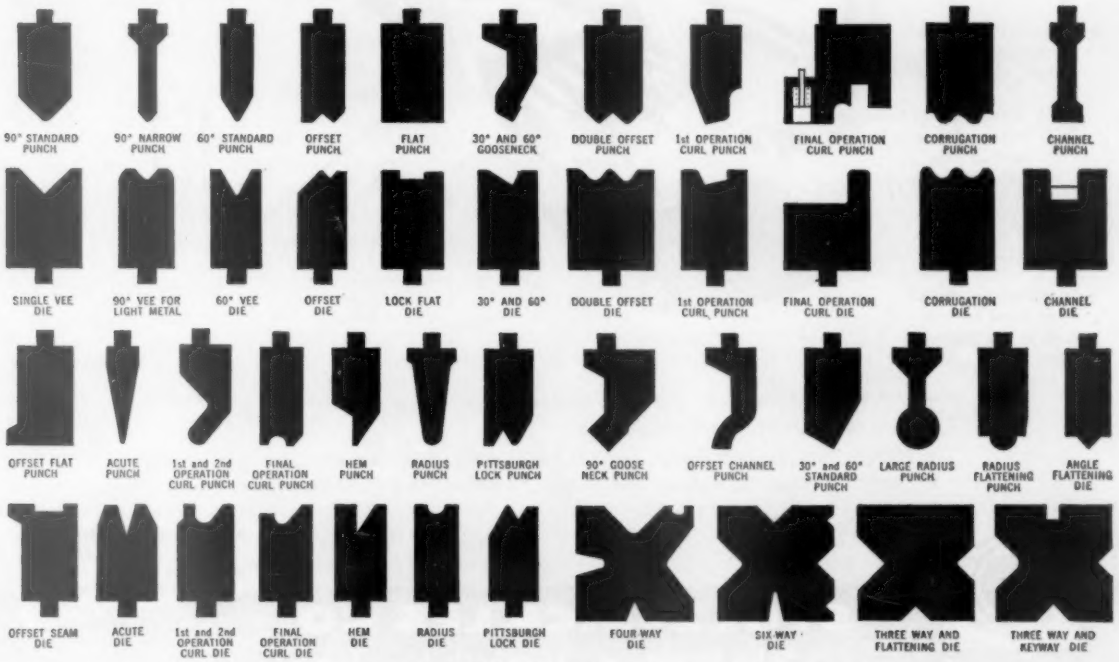
The following formula is the basis for the figures shown on the tonnage chart below:

$$\text{Average pressure per foot of length in tons} = \frac{\text{Thickness of Pl. x Ult. St.}}{\text{125 x Die Ratio}}$$

THICKNESS OF METAL		WIDTH OF VEE DIE OPENING																					
Gauge	Inches	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	7	8	10	12
20	0.036	2.5	**2.2**	1.7	1.4	1.1																				
18	0.048	4.4	3.5	**2.9**	2.6	2.2	1.8																			
16	0.060		5.8	4.8	4.1	**3.6**	2.9	2.4																		
14	0.075			7.2	6.2	5.4	**4.5**	3.6	3.1																	
12	0.105					10.6	8.4	7.1	**6.3**	5.3	4.7															
11	0.120						11.6	9.2	7.9	**7.2**	6.2	5.5														
10	0.135							11.7	10.0	8.8	**8.1**	7.0	5.8													
3/16"	0.188									17.0	15.0	13.6	**11.3**	8.5	6.8											
1/4"	0.250											24.0	20.0	**15.0**	12.0	10.0										
5/16"	0.313												31.9	23.5	**18.8**	15.6	13.4									
3/8"	0.375													33.9	27.0	**22.5**	19.2	16.9								
7/16"	0.438														36.8	31	**26.3**	22.8	18.4							
1/2"	0.500															40.0	34.3	**30.0**	24.0	20.0						
5/8"	0.625																53	46.8	**37.5**	31.2	26.7					
3/4"	0.750																	68	54	**45.0**	38.5	33.7				
7/8"	0.875																		73.6	61.3	**52.5**	46	37			
1"	1.000																			80	68	**60.0**	48	40		

The Tonnages in Bold Face in the Above Table are for Vee Die Openings Eight Times the Thickness of the Metal. An Eight Time Opening is normally used for Right Angle Bending Work.

DIES FOR POWER PRESS BRAKES



NEXT MONTH: *In the second part of the metal fabricating processes report, we will discuss metal cutting: Arc cutting and gouging, flame cutting and gouging, and mechanical cutting. A buyer's guide will be included for each category.*

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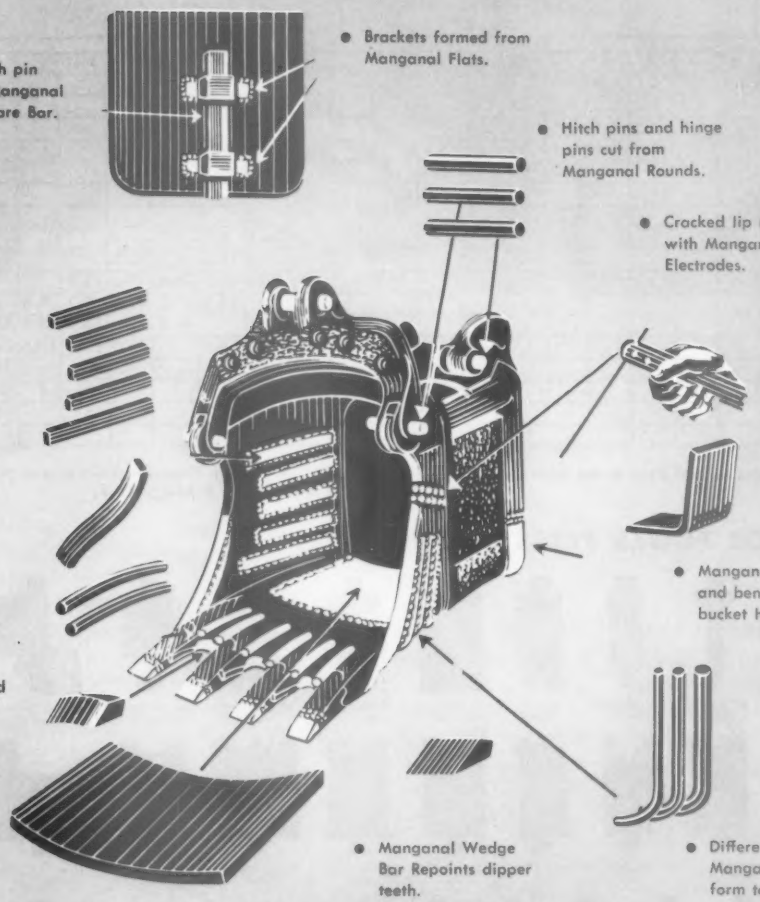

- Bucket door flame-cut from Manganal Hot Rolled Plate.
- Latch pin is Manganal Square Bar.
- Brackets formed from Manganal Flats.
- Hitch pins and hinge pins cut from Manganal Rounds.
- Cracked lip repaired with Manganal Electrodes.
- Manganal Flats line sides of bucket.
- Hot Rolled Manganal Wedge Bars bent to form cutting edge for worn lip.
- Manganal Rounds reinforce worn tooth sockets.
- Manganal Hot Rolled Wedge Bar forms cutting edge between teeth.
- Manganal Hot Rolled Plate flame cut and bent to line bucket floor.
- Manganal Wedge Bar Repoints dipper teeth.
- Manganal Flat cut and bent reinforces bucket heel.
- Different sizes of Manganal Rounds form tapered lip.

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REFERENCE DATA *catalogs, handbooks, manuals*

NEW ELECTRODE DATA sheets for "Sureweld" AC and DC electrodes are available from National Cylinder Gas Div. of Chemetron Corp. Welding characteristics and current ranges are given for mild steel, medium and high carbon, and railwear electrodes.

Circle No. 300 on Reader Service Card

A PLASMA FLAME SPRAY GUN for applying high density coating of high temperature materials is illustrated in a brochure from Metallizing Engineering Co., Inc. Applications are suggested for this new MB gun that produces flame temperatures as high as 30,000°F.

Circle No. 301 on Reader Service Card

MANUAL EQUIPMENT for consumable electrode inert-gas-shielded welding is the subject of a 16-page catalog (F-1393) issued by Linde Co., Div. of Union Carbide. The Sigmatic line of welding machines, torches and controls is featured.

Circle No. 302 on Reader Service Card

BRAZING TECHNIQUES for use on all commercial brazeable metals and alloys are described in a 24-page manual offered by All-State Welding Alloys Co., Inc. Information on flame and torch settings, alloy selection, and joint design is included.

Circle No. 303 on Reader Service Card

HARDSURFACE WELDING, including selection of electrodes and wires, is covered in Bulletin MW-225 published by A. O. Smith Corp. Complete tables give valuable information on 25 electrodes and wires and their use on 500 different applications.

Circle No. 304 on Reader Service Card

EXPANDED SIZE RANGE of taper-face flanges is described in revised Bulletin TT942 from Tube Turns Div. of Chemetron Corp. Dimensions are given for a complete line of lightweight fittings and taper-face welding neck flanges.

Circle No. 305 on Reader Service Card

A MOISTURE STABILIZER for welding electrodes is the subject of literature issued by the W Corporation. Described and illustrated is a portable, insulated, electrically heated, and thermostatically controlled container that keeps electrodes at factory-specified moisture content.

Circle No. 306 on Reader Service Card

A 24-PAGE CATALOG on Tuffaloy resistance welding tips, tip holders and alloys has been issued by Air Reduction Sales Co. This is the first catalog to use the new "RW" taper numbering system for specifying spot welding tip size. Shown for the first time are new holders in straight, offset, close-coupled and universal styles.

Circle No. 307 on Reader Service Card

GUIDE TO POSITIONING EQUIPMENT is available from Ransome Company. Illustrated brochure gives complete details and operating specifications for company's complete line of welding positioners, manipulators, turning rolls, turntables, and head and tailstocks.

Circle No. 61 on Reader Service Card

TIG WELDING TORCHES are featured from Tec Torch Co., Inc. Described and illustrated are water-cooled and air-cooled models, along with spot guns and pencil torches with offset nozzles.

Circle No. 69 on Reader Service Card

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

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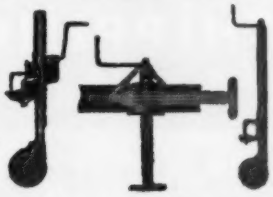

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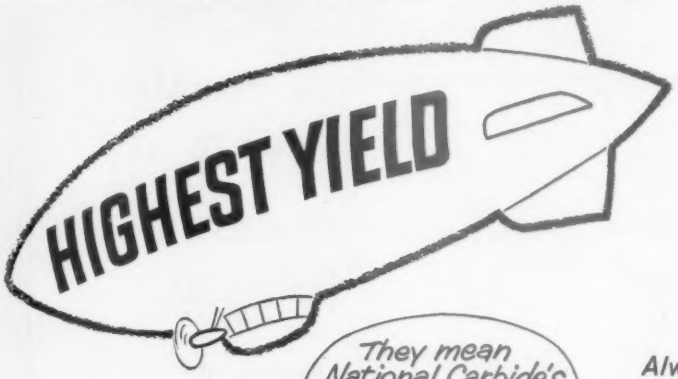

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TYPE C—Drift and Chisel. Same as Type CB but without brush. Weight 14 oz.

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For More Information Circle No. 15 on Reader Service Card.

HYDRAULIC PRESS BRAKES are the subject of Catalog No. 2024 issued by Cleveland Crane & Engineering Co. Described and illustrated is a complete line of press brakes in capacities to 2000 tons.

Circle No. 16 on Reader Service Card.

MAGNETIC GROUND CLAMP which can be positioned for welding (or removed) in seconds is subject of literature from Magne Cast Tool Co.

Circle No. 57 on Reader Service Card.

ROTARY BENDERS for the forming of tube, pipe, bars, structural shapes, and channels from the commonly used metals are described in a catalog published by Wallace Supplies Mfg. Co. Benders ranging from hand to automatic types are featured.

Circle No. 310 on Reader Service Card

CLAMPS and locking tools for smooth clamping of hose, insulation and cable are illustrated in Punch-Lok Company's new 6-page folder F-310. A clamping machine and maintenance kit are also described.

Circle No. 60 on Reader Service Card.

A COLD METAL FORMING machine is illustrated in a bulletin from Curvit Div. of the Maclodyne Corp. The C-155 is engineered for fast coiling and forming of pipe, tube, flat stock, solid bars, angle channel, and extruded shapes.

Circle No. 311 on Reader Service Card

NON-DESTRUCTIVE TESTING using spray cans and squeeze bottles is featured in a colorful bulletin from Magnaflux Corp. Four portable kits for Magnaflux and Magnaglo testing are illustrated.

Circle No. 51 on Reader Service Card.

THE COMPLETE LINE of automatic and semiautomatic arc welding equipment made by Hobart Bros. Co. is featured in a new 6-page folder. Applications are also illustrated.

Circle No. 312 on Reader Service Card

TECHNIQUES FOR WELDING small diameter, non-critical piping are described in 4-page Bulletin 2112.3 from Lincoln Electric Co. Procedure and cost information is included.

Circle No. 313 on Reader Service Card

VERSATILE METAL WORKERS which do a wide variety of cutting operations on a wide variety of metals are featured in an illustrated brochure from Homestrand Machine Tool Corp.

Circle No. 36 on Reader Service Card

NEW TWO-SPEED GEARING of their redesigned press brakes is explained in literature from Excelsior Tool and Mach. Co. Complete line of 15-through 200-ton brakes is described and illustrated.

Circle No. 314 on Reader Service Card

LAYOUT AND SET-UP BLOCKS or welding platens, tools and accessories are illustrated in a 2-color data sheet published by Acorn Iron and Supply Co. Sizes are listed and typical applications are shown.

Circle No. 315 on Reader Service Card

THE MEDICAL DIVISION of National Welding Equipment Co. has issued 20-page Catalog 10 which describes and illustrates a complete line of oxygen equipment and accessories for hospital use.

Circle No. 316 on Reader Service Card

FOR WELDING HEAVY PLATE or the thinnest alloys—that's how Vickers Incorporated, Electric Products Division, describes its magnetic amplifier DC welder. Complete information on the welder—and accessories—is given in available literature.

Circle No. 317 on Reader Service Card

WELDING PLASTICS with a new plastic welding kit is explained in a 2-page data sheet issued by American Agile Corp. The kit comes complete with tools, supplies, and operating instructions for use in welding and fabricating Thermoplastics.

Circle No. 318 on Reader Service Card

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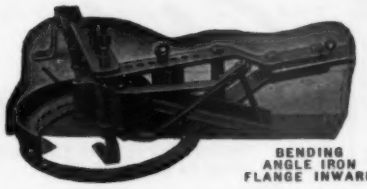
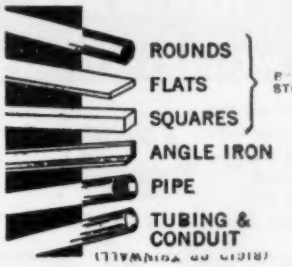


BENDING ANGLE IRON FLANGE INWARD



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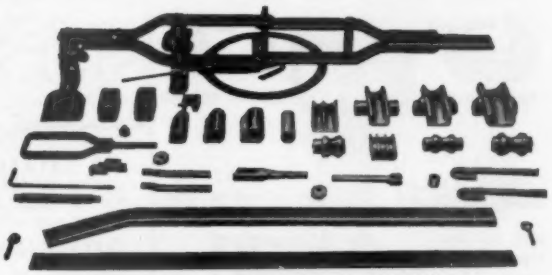

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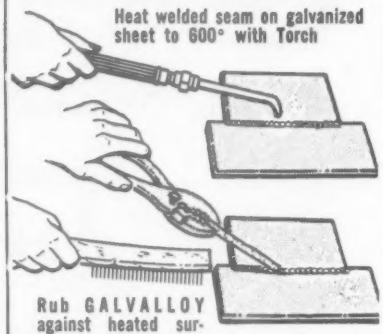

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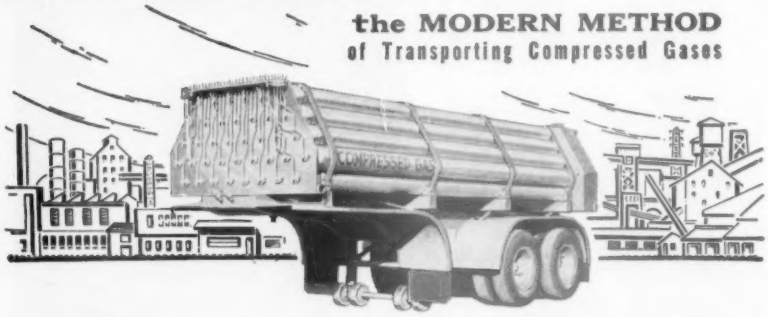

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- MANIFOLD & CONTROLS — for YOUR Gas and Handling Requirements
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CYLINDERS AND GAS PRODUCING EQUIPMENT
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For More Information Circle No. 37 on Reader Service Card.

USEFUL LITERATURE *continued*

PIERCING, NOTCHING and blanking presses in capacities from 100 to 800 tons are described in 16-page Bulletin No. 52200 from the Federal Machine & Welder Co.

Circle No. 319 on Reader Service Card

PIPE WELDING CLAMPS for every job are featured in literature from Jewel Mfg. Co. Described and illustrated are pipe, elbow, angle and flange clamps.

Circle No. 40 on Reader Service Card

TUNGSTEN ELECTRODES are featured in literature from Sylvania Electric Products, Inc. Described are Puretung, Zirtung, 1% Thoriated, and 2% Thoriated electrodes that come in the preferred finish —cleaned or ground, and are color-coded for easy identification.

Circle No. 320 on Reader Service Card

NEW READY PACK industrial X-ray film available from Eastman Kodak Co. is featured in literature which explains the convenience of having radiographic film sheets individually sealed in a light-tight envelope ready for exposure.

Circle No. 20 on Reader Service Card

HARDSURFACING with new Model D Spray-welder is described in a 4-color Bulletin (Form 3000) issued by Wall Colmony Corp. Specifications of the five powders available for use with the unit are included.

Circle No. 321 on Reader Service Card

A PORTABLE X-RAY UNIT is described in a new brochure from Balteau Electric Corp. Complete specifications are given for the Baltospot 150 which is designed for a variety of testing applications.

Circle No. 322 on Reader Service Card

FOUR-EDGE SHEAR KNIVES are described in a bulletin from Simonds Saw and Steel Co. Six solid steel knives for all shearing applications are featured.

Circle No. 323 on Reader Service Card

Circle No. 11 on Reader Service Card.

BATEMAN BANTAM IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

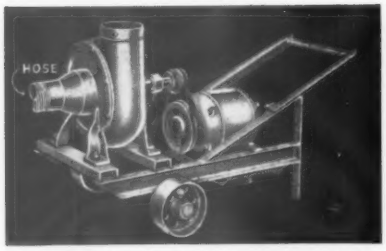
The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

RUEMELIN *Portable*
Fume Collector

Removes gas, smoke and heat from welding operations. Recommended for ventilation of tank interiors, manholes, vats, airplane fuselages or for blowing fresh air into inaccessible places.



• Collector is equipped with a power unit capable of handling up to 35 ft. of steel tubing. Mounted on rubber tired wheels for ease of handling. Models also available mounted on steel legs for hose operation in a complete 360 degree circle.

• This view shows inlet hood picking up welding smoke. Operator breathing zone protected.

WRITE FOR DETAILED INFORMATION.

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3932 N. Palmer St., Milwaukee 12, Wis. U.S.A.

Manufacturers and Engineers • Sand Blast and Dust Collecting Equipment • Welding Fume Collectors

Circle No. 62 on Reader Service Card.

A MINIATURE PRESS BRAKE which develops 4½-tons pressure and does any job a large standard press can is the subject of literature from Rotex Co.

Circle No. 324 on Reader Service Card

A COMPLETE LINE OF SHEARS is illustrated in a folder issued by Beverly Shear Mfg. Co. Pneumatic, throatless, and slitting shears and electric throatless nibbling shears are described. Specifications are given.

Circle No. 325 on Reader Service Card

A 24-INCH BOX AND PAN BRAKE is featured in a folder from Peck, Stow & Wilcox Co. The folder gives specifications and lists optional equipment for this compact machine with flip-over gauging.

Circle No. 326 on Reader Service Card

CLAMPS FOR HOSE, plastic pipe and other industrial uses are described in a catalog published by Ideal Corp. Four types are illustrated; dimensional drawings and specifications are given.

Circle No. 327 on Reader Service Card

PLANT FACILITIES FOLDER shows standard radial draw forming facilities and a new series of production forming machines. It's available from Cyril Bath Company.

Circle No. 28 on Reader Service Card

MAINTENANCE WELDING data book issued by Eutectic Welding Alloys Corp. is in its seventh edition. The 148-page illustrated publication includes new application and design data and indexes by application 200 different Eutectic welding rods, electrodes, and chemical aids.

Circle No. 332 on Reader Service Card

LIGHTWEIGHT AND PORTABLE Woodruff keyseat cutting machine saves hours of disassembly time by cutting keyseats right at the job. Literature from Gary Steel Products described unit and tells how it works.

Circle No. 333 on Reader Service Card

***Tempilstik*°**
*temperature indicating crayons**

**Also Tempil° Pellets and Tempilaq° (liquid form)*

***Tempilstik*°—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.**

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- ☐ PUROX apparatus
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- ☐ UNIONMELT apparatus
- ☐ PREST-O-LITE small tanks, appliances, and acetylene
- ☐ LINDE industrial gases

Your LINDE distributor is a welding specialist, superbly equipped and stocked for immediate delivery of a full line of quality products. To his already extensive list, the *Oxweld* line adds the most efficient high quality gas welding materials available today. There's a LINDE distributor near you. Call him for *all* your welding needs. Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto.

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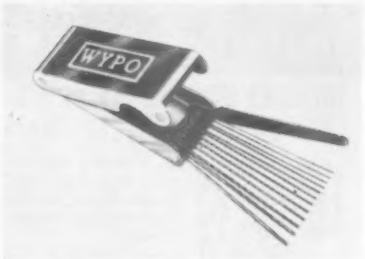
Linde UNION CARBIDE

For More Information Circle No. 43 on Reader Service Card.

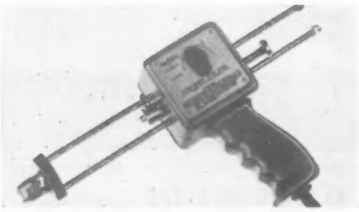
NEW PRODUCTS



Tip Cleaner Sets Have Polishing File

A new polishing file will be included in all three of their stainless steel Wypo tip cleaners sets by Maitlen and Benson, Inc., Long Beach, California, manufacturer of cutting and welding tip cleaners. Wypo tip cleaners and polishing files are contained in a handsome, polished aluminum case, which serves as a handle for the file when it is used.

Circle No. 56 on Reader Service Card



Air Spot-Weld Gun

Bren Weld Corporation has announced their new model H arc spot weld gun. The gun features automatic time control. This insures uniform welds from one side without back up. No triggers or buttons are used during the welding operation.

The Model H gun weighs only two pounds. It welds mild, galvanized and stainless steels up to 14 gauge.

Circle No. 200 on Reader Service Card

Self-Fluxing Brazing Rods

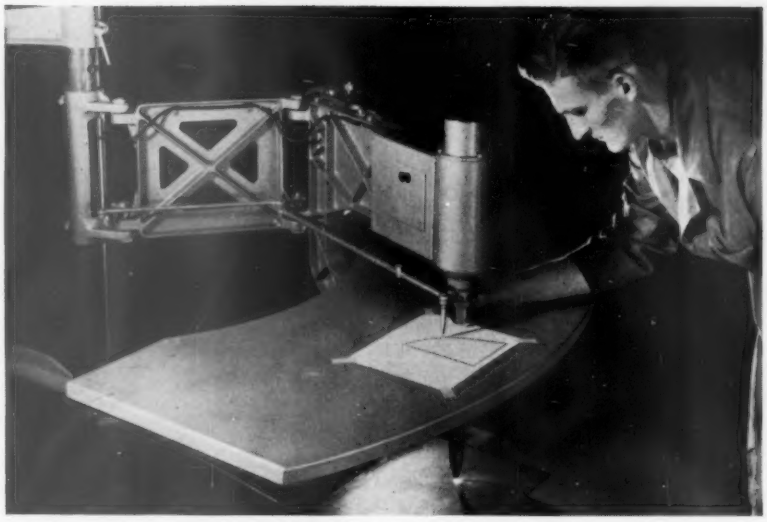
Improved surface finishes on Silvaloy 15 and Silvaloy 5 silver brazing rods have bettered the self-fluxing properties of those alloys, according to the American Platinum & Silver Division of Engelhard Industries, Inc. The new rods are easily distinguished by their bright, silvery appearance.

While paste fluxes may be used with these alloys, their self-fluxing ability makes them useful in silver brazing joints where complete flux removal is difficult and important.

Silvaloy 15 contains 15% silver, 80% copper, and 5% phosphorus. Its optimum brazing temperature is slightly above 1280°F, at which point melting is virtually complete.

Silvaloy 5 contains 5% silver, 88.75% copper, and 6.25% phosphorus.

Circle No. 201 on Reader Service Card



Swiss Flame Cutter Is Available In This Country

The Gloor Expeditor, a new Swiss-made flame cutter is designed as a fast, accurate, highly versatile production tool for design, development and proto-type work. It is available through Earth Equipment Corp.

The Expeditor's unique control permits an operator to duplicate directly from a sketch or drawing by manually controlled tracing pencil. It also features automatic magnetic control for precise template work, and automatic right angle, straight line or circular cuts.

Circle No. 202 on Reader Service Card

Mechanical Shear

An all-welded 300-ton mechanical shear has been introduced by Steelweld Machinery Div. of the Cleveland Crane & Engineering Co. The shear features air-operated clutch and brake, fast microset knife adjustment, and automatic lubrication for all principal parts. Steelweld mechanical shears are available for cutting steel in lengths to 30 feet and thicknesses to two inches.

Circle No. 203 on Reader Service Card

Adjustable Electrode Holder

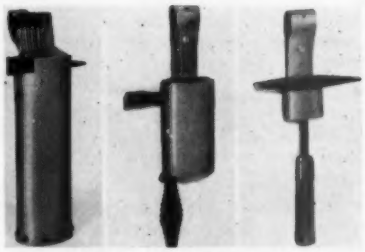
An electrode holder which allows easy adjustment of spring tension has been announced by The Duro Engineering Company.

The aluminum model A3T is rated at 300 amperes and weighs only 12 ounces. It will handle almost all jobs.

The holder is designed for easy parts replacement and good visibility. The low lever is designed for easy opening of the jaws.

A bronze model is also available.

Circle No. 19 on Reader Service Card.



Holsters For Tools

Welders can carry hammers at their belt with the new line of "Fast-Draw" safety holsters made by Atlas Welding Accessories, Inc. The holsters are made of heavy full grain saddle leather and are offered in 3 models.

Model 19 carries practically any type hammer. Model 21 carries combination weld chipbrush tools. Model 192 in a full length case. It holds not only the chipping tool, but a supply of welding rod.

Circle No. 204 on Reader Service Card

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Your LINDE Distributor carries a *complete* line of all the welding and cutting equipment and supplies you need in your business. These are products recognized for their outstanding high quality and efficiency. In most instances, he can fill your order *from stock*, to save you time and effort.

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Your LINDE Distributor is as convenient to you as your telephone—call him for all your welding and cutting requirements. If you have not yet made his acquaintance, look in the Yellow Pages under "Welding Supplies." Or write Dept. 330, LINDE COMPANY, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N.Y.

Linde UNION CARBIDE

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ROD or BAR:
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FORGINGS:
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ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with:
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and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

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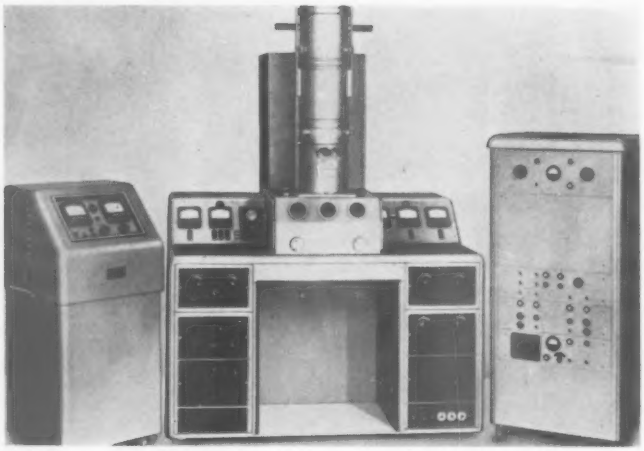


Electron beam welder for hard-to-weld metals

ALL SIX ADVANTAGES of electron beam welding are offered by a new German machine being sold here. The advantages:

- Excellent depth-to-width ratio . . . high concentration of thermal energy at work makes possible welds with depth-to-width ratios as high as 20:1.
- Narrow fusion zone . . . small beam concentrated on weld makes narrow fusion and heat-affected zones. This means less shrinkage and distortion. Grain growth is kept to a minimum. Sometimes the heat-affected zone has a finer crystal structure than the surrounding metal.
- No contamination . . . welding is done in a vacuum chamber without shielding gases or filler metals that might introduce impurities. Any impurities in the parent metal are vaporized from the fusion zone.
- Close control of penetration . . . the depth and width of the weld can be controlled closely to get partial or complete penetration.
- Close dimensional controls . . . high energy electron beams are concentrated on an extremely small area; focal spot is less than 0.001 inch diameter.
- No postwelding operations . . . stress relieving, cold working or heat-treating usually are not needed.

The Zeiss machine has welded stainless steel for aircraft and missiles, T-sections 0.060 inch thick from sheet stock at 84 ipm. It will butt weld 3/8 inch stainless at 20 ipm and has welded one inch stainless in the laboratory.

The machine consists of six units:

- Electron gun that develops a precisely controlled beam of electrons with high energy density to heat, melt, or vaporize a work piece.
- Vacuum chamber, containing work table on which work can be positioned for welding.
- High vacuum pumping system, creating a vacuum of about four millionths of an inch of mercury.
- Electronic control system, which manipulates the electronic deflectors and lenses that control the size and programming of the electron beam.
- Precisely regulated high-voltage power supply.
- Monitoring instruments.

The Zeiss machine, which also can be used for milling, is sold in this country by Hamilton-Electrona, Inc. The company is jointly owned by The Carl Zeiss Foundation and the United Aircraft Corp., whose Hamilton Standard Division will make the machine here. ••

Circle No. 205 on Reader Service Card

New Brazing Concept

A new concept in flux-coated brazing rods has been announced by All-State Welding Alloys Company, Inc. Two types of bronze brazing rods with totally engineered extruded flux coatings are being produced by the company. One is a thin-coated rod for high-speed production lines. The other is an all-around heavier-coated maintenance rod for general use.

These bronze rods are said to offer the user just the right amount of flux for all brazing operations. They are flux-coated with a special non-fuming, non-charring flux that will not crack off the rod even when the rod is bent over 360°. Clean-up is negligible if proper brazing techniques are used. The non-hygroscopic flux coating allows unlimited storage of brazing rods. Packaged in tough 10-lb. tubes, the rods are available in the following sizes: 3/32" x 36", 1/8" by 36", 3/16" x 36" and 1/4" x 36".

Circle No. 206 on Reader Service Card

For More Information Circle No. 63 on Reader Service Card.

SMS CORPORATION

Headquarters for Resistance Welding Supplies

R.W.M.A. Classes of alloys in castings, forgings and bar stock; copper tungsten alloys

Standard electrodes; special electrodes and fixtures designed and built

All types of straight and offset holders

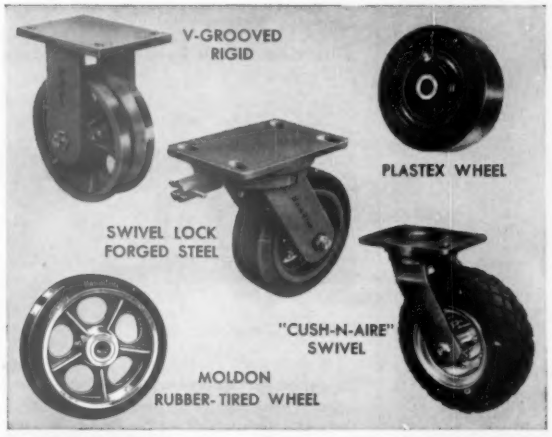
Welder wheels in all alloys and sizes

Tip dressers, reamers and contour dressers

Adjust-A-Pressure holders (above, left) used with Adjust-A-Angle adapters solve many welding problems; change from one electrode spacing to another — a matter of minutes — with the same set-up.

S-M-S CORPORATION

2254 COLE AVENUE • BIRMINGHAM, MICHIGAN



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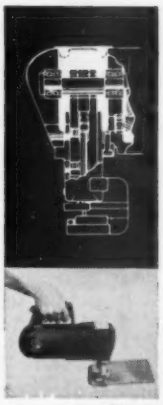
CUT ¼ INCH STEEL PLATE EASILY AND IN ABSOLUTE SAFETY

with the **FENWAY** MODEL EHN

heavy duty NIBBLER



The new, lightweight Fenway ¼" Nibbler cuts through ¼" cold or hot rolled steel plus 5/16" aluminum, quickly and easily. Also cuts 8 gauge stainless. Its special design provides absolute safety to the operator and will cut without distortion to material. Clean cutting action reduces need for grinding and buffing edges. Has minimum cutting radius of 8". Weighs only 20 lbs. SEND FOR COMPLETE SPECIFICATIONS OR ASK FOR FREE DEMONSTRATION IN YOUR AREA.

Other Fenway Nibblers are available for a variety of cutting jobs ...help reduce costs as much as 75%.

FENWAY MACHINE CO., INC.
3107 N. Broad St., Phila. 32, Pa.

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Circle No. 72 on Reader Service Card.

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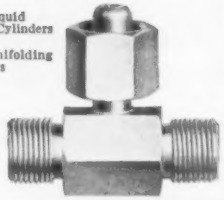
OXYGEN COUPLER TEE

1. For Liquid Oxygen Cylinders
2. For Manifolding Cylinders



Part #T-62

(1) Permits use of two oxygen regulators with one cylinder and (2) with pig-tail assemblies. Write for catalog price sheet.

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BECKER Keen-Cut Electrodes for use in

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KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity ... longer life ... shorter cutting time ... greater material removal ... smooth surface gouge ... controllable accuracy ... hot stable cutting arc ... elimination of smoke and gases.

And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

Write for Catalog

BECKER BROTHERS CARBON CO.

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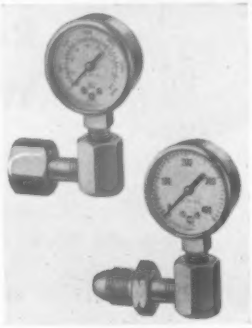


Cylinder Testing

New cylinder testing gauges for checking amount of gas in all types of cylinders have been introduced by Western Enterprises, Inc. Available in two types—400-lb. for all acetylene cylinders, and 3,000-lb. for hydrogen, nitrogen, argon and oxygen—the testing gauges eliminate the need for carrying regulators on cylinder deliveries. They also can be used by customers to check the amount of gas in cylinder stocks.

According to the manufacturer, the gauges may be used with nine different fittings. A testing block without gauge or nut and nipple is also available.

Circle No. 318 on Reader Service Card

Lightweight Oxygen-Saver

Harris Calorific Company announces the introduction of a new oxygen-saver for flame cutting equipment. The new No. 33 duo-control unit for single torch, cutting machine operation permits the use of high heat flame for instant starts. When actuating the pre-heat oxygen control lever, the flame needed to support continuing cutting action is reduced to a minimum.

This new oxygen-saver is said to reduce by 70% the amount of preheat gases used. The manufacturer says there is less hardening of surface cut, no rounding of kerf edge, and little slag. The unit weighs only 12 ounces.

Circle No. 207 on Reader Service Card

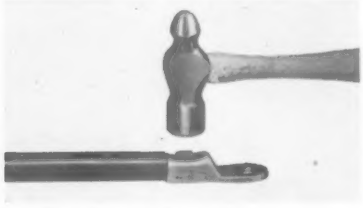
Hardfacing Machine

A new, lower-cost machine for automatic rebuilding of tractor rollers and idlers, the Victor Model B, is announced by Victor Equipment Company. Victor Model B sells for less than two-thirds the price of the larger, production-type Victor Model DEMS rebuilder, yet has the same double-wire feed, automatic move-over, and motorized positioning of work. Chief difference is capacity. Model DEMS has a double-ended multiple spindle that mounts eight track rollers at a loading; Model B has a double spindle, mounts only two rollers or idlers.

A built-in ¼-ton jib crane lets operators position rollers and large idlers with ease. Controls are centralized. Modular design of electronic controls simplifies maintenance and troubleshooting.

Price includes constant potential, single console, dual 500 ampere, 100% duty cycle power source, and caster-mounted flux buggy.

Circle No. 208 on Reader Service Card



Cable Connections

A hammer is the only tool needed to make a perfect connection everytime with "RED-E" lugs and splicers, to welding and power cables. Recently introduced by Bernard Welding Equipment Co., of Chicago, these lugs and splicers eliminate special crimping tools, wrenches, & soldering equipment. The "RED-E" lugs & splicers are easily installed by merely inserting the stripped cable and then driving down a self-contained impact punch with an ordinary hammer. The connectors also feature large easy-to-read cable size markings and a handy stripping gauge stamped on the side of each connector. The "RED-E" connectors are available in a full range of sizes, from No. 6 thru 1 and 1/0 4/0.

Circle No. 209 on Reader Service Card

Flux-Coated Silver Brazing Alloy

A flux-coated silver-brazing alloy, which is said to cut brazing time by two-thirds through elimination of separate flux, has been introduced by Eutectic Welding Alloys Corp. The company explains that Eutec Sil 1020FC alloy eliminates the need for flux mixing and application and reduces the need for precleaning and preheating.

Eutec Sil 1020FC is available in rods of 1/16 and 3/32 inch diameter. It can be used for ferrous and nonferrous metals and all types of joints, including tee, butt, fillet, and lap or sleeve. Features include low application temperature and high fluidity, strength, and high electrical conductivity. Deposits are cadmium-free. This means the product may be used safely on food vessels and processing equipment.

Circle No. 210 on Reader Service Card

Lightweight Face Shield

A new low priced face shield is now being distributed by The Fibre-Metal Products Company.

Designated "Feather-Lite F-90", the new face shield weighs only 3-¼ ounces complete with a 6" x 11-½" x 0.020" window. All parts are easily replaceable. A great variety of windows and screens are available. The vulcanized fibre deflector accommodates all spectacle frames.

Circle No. 211 on Reader Service Card

Electric Hydraulic Presses

Two medium-capacity electrically-powered hydraulic presses have been introduced by the ACCO Equipment Division, American Chain & Cable Company, Inc. They are engineered to handle jobs requiring pressures of 25 and 40 tons.

Both units are equipped with a pressure by-pass valve to prevent overloading or damaging a press. A pressure gage records pressures during operation. The pump is powered by a 220/440 volt, 3 phase, 60-cycle motor.

Both presses are attractively finished in machine-tool grey. Model HP-25-E22 is equipped with a 2-hp. motor, has a ram speed of 28-in. per minute at no load and 12.2 in. at full load. The Model HP-40-E22 is equipped with a 2-hp. motor, has a ram speed of 17-in. per minute at no load and 8-in. per minute at full load.

Circle No. 212 on Reader Service Card

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in the familiar green drum

Warehouse stocks in all important cities and towns.

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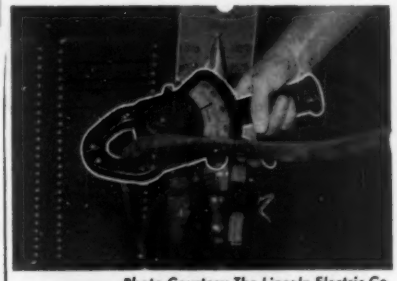

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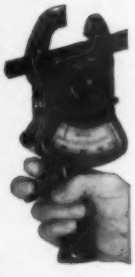
Only TONG-TEST measures both AC and DC

Weld with confidence. Use the exact amperage—no more, no less—to assure welding quality. Prevent costly rejects by controlling the welding current (AC or DC) with one TONG TEST AMMETER. Simply snap tongs around electrode cable — read amps instantly and accurately. No electrical connections required, cannot burn out. Interchangeable ranges up to 1000 amperes.



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On and Off in seconds . . . No awkward clamps, screws or springs needed to hold ground to work.

Rugged aluminum body makes for improved electrical contact; ground remains cooler, thus increasing efficiency of welder.

A great time-saver . . powerful, long-lasting built-in Alnico magnets produce a vise-like grip that holds the ground hog to work in any position . . . on flat, round or angular surfaces.

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Short Leg Clamp

A 2-ton structural clamp was designed by Merrill Bros. Co. with a "short leg" feature. It provides a secure bite on even small beams. This clamp eliminates time lost in slinging, attaching and releasing work in the process of moving.

These clamps have a grip range of 0-1"; are 100% proof tested at 6 tons and have a safety factor of 5 to 1.

Circle No. 213 on Reader Service Card

AC Arc Welder

A new AC arc welding machine has been announced by Metal & Thermit Corporation. The machine features simplified adjustments and built-in control of arc characteristics.

The welder has 66 heat settings over a 7 to 300 ampere current range. Automatic voltage control regulates the arc according to the gauge being welded.

An accessory package is also available.

Circle No. 214 on Reader Service Card

Gamma Inspection

A new, inexpensive line of gamma radiography equipment has been announced by Radiation Engineered Services.

The machines utilize the radioisotopes cobalt 60, iridium 192, cesium 137 and thulium 170 in the non-destructive inspection of metal castings, parts and weldments through gamma radiography, similar to industrial x-ray.

Fourteen basic machines are offered, with a variety of mounts. All machines may be obtained with more than one source position, permitting the use of two or more sources with different radiographic properties with the same unit. Most of the equipment may be used for panoramic exposures. Some of the units may be used for beam exposures.

Circle No. 215 on Reader Service Card

FACTS AT YOUR FINGERTIPS: *If you want information on products featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card.*

MURCO POWER DRIVEN forge hammers

BELT DRIVEN 5 SIZES

MOTOR DRIVEN

Extremely powerful yet comparatively simple in design, MURCO Power Driven Forge Hammers can be operated under perfect control and with very little effort. Illustrated are the five sizes of motor driven models made in 25; 50; 100; 250; and 500 pounds RAM. The RAM design is a special feature . . . a steel casting, balanced and carefully machined, operates in V guides . . . large bearings for toe and toggle bolts . . . guide bearings extra long and wide. Perfect alignment of Ram Travel prevents twisting because the Ram is parallel with travel—a very important feature. Write today for complete specifications and price on the model to meet your requirements.

MURCO Power Driven Forge Hammers are also made in five models belt driven in 25; 50; 100; 250; and 500 pound ram sizes.

D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883 WAUSAU, WISCONSIN

For More Information Circle No. 55 on Reader Service Card.

Get the lion's share of meaty facts out of this issue of WELDING DESIGN & FABRICATION before you pass it along to the next reader. Leaf through once more: If you want full details on any item, the Reader Service Card will bring them to you quickly. No postage needed.

Airco Pacific Expands Air Separation Plant

SAN FRANCISCO: A million dollar expansion of Air Reduction Pacific Company's new air separation plant at Richmond was announced recently by Harold P. Etter, president.

The expansion program will boost the rated capacity of the installation to more than 65 tons per day of high purity liquid oxygen, nitrogen and argon. The air separation plant which Air Reduction Pacific opened in March, will be expanded to increase production by 20 percent and a second unit will be built to serve the San Francisco Bay area. The new unit will produce 32 tons per day of liquid oxygen, nitrogen, and argon.

Scheduled for completion early in 1961, the new construction will add 7,000 square feet of floor space and will provide storage for an additional 10,000,000 cubic feet of industrial gases.

Air Reduction now operates 15 plants on the West Coast.

Pressed Steel Tank Relocates Two Offices

MILWAUKEE: Pressed Steel Tank Corp., has announced that district offices serving the New York and Chicago metropolitan areas have recently moved to new locations.

The New York district office is now located at 1199 Main Avenue, Clifton, N. J. The Chicago district office has moved to 6634 North Western Avenue.

Metco Is New Name For Metallizing Firm

WESTBURY, N. Y.: A broader product range is reflected in a name change by Metallizing Engineering Co., Inc., which will now be known as Metco, Inc. Metco's president, Rea Axline, explains: "When this company was founded in 1933 the term 'metallizing' was truly descriptive of our products. Today our products embrace all phases of flame spraying."

MISS WELDOR OF 1960 is Juli Reding, rising young star of television and motion pictures. Official pin-up photos of Miss Reding are ready for distribution to welding operators around the world by Eutectic Welding Alloys Corp., Flushing, N. Y., which annually sponsors competition for the title.

Westinghouse Renames Welding Department

BUFFALO: Westinghouse Electric Corp. has announced that its Welding Department is now called the WEST-ING-ARC Department. WEST-ING-ARC formerly applied largely to the gas shielded welding process developed by Westinghouse.

The company feels this more inclusive term identifies the broadening activities of the department. The department and all its products will be known by the new name.

Circle No. 26 on Reader Service Card.

IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

MORT CLARK'S GALV-WELD® ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959—23 YEARS LATER!

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WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

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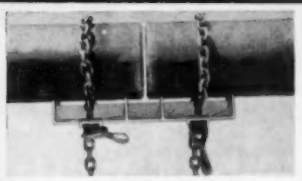

The JEWEL Pipe Clamp
. . . aligns and holds pipe for tacking. Two sizes: ½" to 8" and 8" to 16". Sturdy construction for hard usage.

The JEWEL Elbow Clamp
lines up welding elbows from 2½" to 8" at right angles to the pipe and holds them until tacked.

The JEWEL Angle Clamp
holds branch line at right angles to the main or headers. Takes any size main or branch from ½" to 12".

The JEWEL Flange Clamp
lines up the flange face at right angles to pipe end and holds until tacked. Takes size from 2½" to 16".

The JEWEL Pipe Marker
marks a perfect hole and saddle on any pipe up to 20".

Write For Details

Jewel Manufacturing Co.
1841 University Ave., St. Paul 4, Minn.

Circle No. 40 on Reader Service Card.

Data Offered In This Month's Ads

Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards

1: SOLDERS for all metals are featured in literature which includes tables. **All-State Welding Alloys Co., Inc.**

2: ALLOY ELECTRODES for every arc welding job are described. **Alloy Rods Co.**

3: A MANGANESE STEEL ELECTRODE and its uses are described in a bulletin. **Amsco Co.**

4: EJECTOR HOLDERS that end leakage during spot welding are explained. **Air Reduction Sales Co., Tuffaloy Dept.**

5: AUTOMATIC CO_2 GUN is described in a brochure giving complete specifications. **Air Reduction Sales Co.**

6: MECHANIZED WELDING of tubes and plates for condensers and heat exchangers are featured in literature. **American Brass.**

7: HELMETS with a "cooling" interior are described in a brochure. **American Optical.**

8: LOW-TEMPERATURE silver brazing with special fluxes is the subject of a booklet. **American Platinum & Silver Div., Engelhard Industries.**

9: RESISTANCE WELDING equipment is the subject of literature. **Ampco Metal, Inc.**

11: A PUNCH AND SHEAR for material under 1/4-inch thick is featured in literature. **Batoman Fdry. & Mach. Co.**

12: "KOOLIE HAT" WHEELS are described in literature. **Bay State Abrasive Products Co.**

13: CARBON ARC GOUGING using Keen-Cut electrodes is featured in material. **Becker Brothers Carbon Co.**

14: A TONG-TYPE AC/DC AMMETER is featured in material. **Columbia Electric Mfg.**

15: CHIPPING HAMMERS in seven styles are described in a brochure. **Chicago Mfg. & Distributing Co.**

16: PRESS BRAKES, both mechanical and hydraulic, are featured in a 52-page catalog. **Cleveland Crane and Engineering Co.**

17: WELDER'S CLAMPS for all jobs are described in a catalog. **Cincinnati Tool Co.**

18: REGULATORS for Acetylene, CO_2, and other gases are featured in a bulletin. **Dockson Corp.**

19: ELECTRODE HOLDERS with adjustable spring tension are described. **Duro Engineering Co.**

20: X-RAY FILM for non-destructive testing is featured in literature. **Eastman Kodak.**

21: ARC WELDING ACCESSORIES and their role in the welding circuits are explained. **Erico Products, Inc.**

22: A NEW MAINTENANCE DATA BOOK and electrode information is available. **Eutectic Welding Alloys Corp.**

23: EXHAUST SYSTEMS, from portables to systems for multiple installations, are described in a catalog. **Engwald Co.**

24: HELMET AND SAFETY CAP combinations are the subject of Bulletin 39. **Fibre-Metal Products Co.**

25: HEAVY DUTY NIBBLERS are featured in data which includes specifications. **Fenway Machine Co.**

26: GALVANIZING of small parts and weldments is described in literature. **Galv-Weld Products.**

27: CASTERS AND WHEELS for industrial uses are featured in a catalog. **Hamilton Caster & Mfg. Co.**

28: PLANT FACILITIES folder shows standard radial draw forming facilities and a new series of production forming machines. **Cyril Bath Co.**

29: AXLE ASSEMBLIES, JACKS, couplers, and spindle assemblies are featured in Catalog 18M. **Hammer Blow Tool Co.**

30: GAUGELESS REGULATORS are described with specifications in a bulletin. **Harris Calorific Co.**

31: GAS TRANSPORTERS are described in literature. **Harrisburg Steel Co.**

32: SEVEN AC AND DC WELDING JOBS can be done with a welder described in literature: **Hobart Bros. Co.**

33: IRON BENDERS available with 147 dies are featured in a bulletin. **Hossfeld.**

34: PIPE CUTTING and beveling machines and accessories are featured. **H & M Pipe Beveling Machine Co.**

35: NIBBLERS that cut all metals fast and without distortion are featured. **Modern Mfg. Co.**

36: METAL WORKERS made in five sizes are described in literature. **Homestrand Machine Tool Corp.**

37: GAS SUPPLY TRAILERS for all needs are discussed in material. **Independent Engineering Co., Inc.**

38: "NOW YOU CAN WELD dissimilar alloys quickly and easily" is the title of a booklet. **International Nickel Co., Inc.**

39: ARC WELDING HELMETS, both fiber glass and vulcanized fiber, are described in literature. **Jackson Products.**

40: CLAMPS FOR various uses are described. **Jewel Mfg. Co.**

41: CONSULT your welding supply distributor about your welding problems. **Lenco.**

42: ENGINEERING SERVICES and consulting are available. **Lincoln Electric Co.**

43: OXWELD APPARATUS is featured. **Linde Company, Division of Union Carbide.**

44: WELDING SUPPLIES DISTRIBUTORS are listed in information from Dept. 330. **Linde Co. Div. of Union Carbide Corp.**

45: TEMPERATURE INDICATORS that melt at desired temperatures are described in literature. **Markal Co.**

46, 47, 48, 49: ELECTRODES for varied industrial uses are featured in literature. **Metal & Thermit Corp.**

50: METALLIZING EQUIPMENT for all requirements is illustrated in a bulletin. **Metco, Inc.**

51: DYE PENETRANT inspection materials in spray cans are described. **Magnaflux.**

52: PORTABLE AND STATIONARY WELDERS are fully described and illustrated in a booklet. **Miller Electric Co., Inc.**

53: AN ELECTRIC HAMMER for weld chipping is described in a booklet. **Milwaukee Electric Tool Corp.**

54: GALVANIZING WELDS is the subject of information which includes a sample. **Metalloy Products Co.**

55: FORGE HAMMERS, both motor driven and belt driven, are featured in literature. **D. J. Murray Mfg. Co.**

56: TIP CLEANERS FOR cutting and welding tools are described in literature. **Maitlen and Benson, Inc.**

57: A MAGNETIC GROUND CLAMP of aluminum construction is described in data. **Magne Cast Tool Co., Inc.**

58: CALCIUM CARBIDE for industrial usage is featured in literature. **National Carbide Co. A Div. of Air Reduction Co.**

59: HIGH PRESSURE CYLINDERS are featured in a catalog giving prices and specifications. **Pressed Steel Tank Company.**

60: HOSE CLAMPS, including prices, are the subject of literature. **Punch-Lok Co.**

61: POSITIONING EQUIPMENT is the subject of a guide book. **Ransome Co.**

62: PORTABLE FUME COLLECTORS are featured in a brochure. **Ruemelin Mfg. Co.**

63: RESISTANCE WELDING SUPPLIES are featured in a catalog. **S-M-S Corp.**

64: CARBIDE valves are the subject of literature. **Shawinigan Products Co.**

65: MANGANESE-NICKEL STEEL for bucket repair is featured in material. **Stulz-Sickles Co.**

66: ABRASIVE WHEELS with depressed centers are featured in literature. **Simonds Abrasive Co.**

67: ELECTRODES for resistance welding are featured in a catalog. **Tipaloy, Inc.**

68: TEMPERATURE INDICATING CRAYONS with 80 different ratings are featured in literature. **Tempil Corp.**

69: TORCHES WITH TRANSPARENT NOZZLES for all applications are described in literature. **TEC Torch Co.**

70: CUTTING TORCHES for acetylene and other fuel gases are featured in literature. **Victor Equipment Co.**

71: NOTCHING TOOL for pipe and tubing is described in literature. **Vogel Tool & Die Corp.**

72: WELDING HOSE care is the subject of a catalog. **Western Enterprises, Inc.**

73: RADIOGRAPHIC INSPECTION of steel up to 4" is described in material. **Westinghouse X-Ray.**

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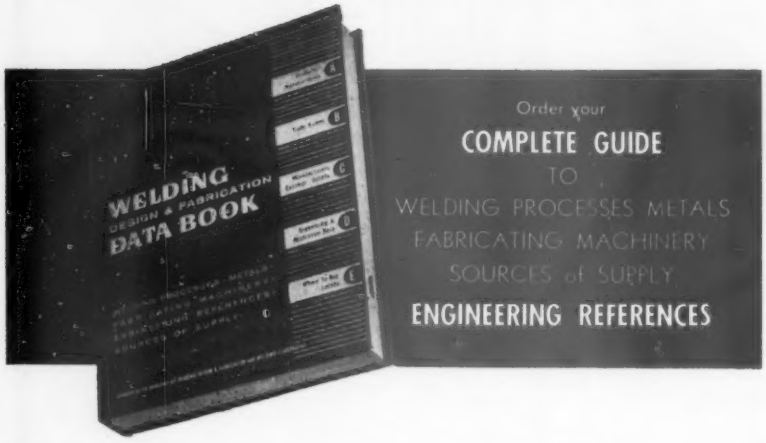

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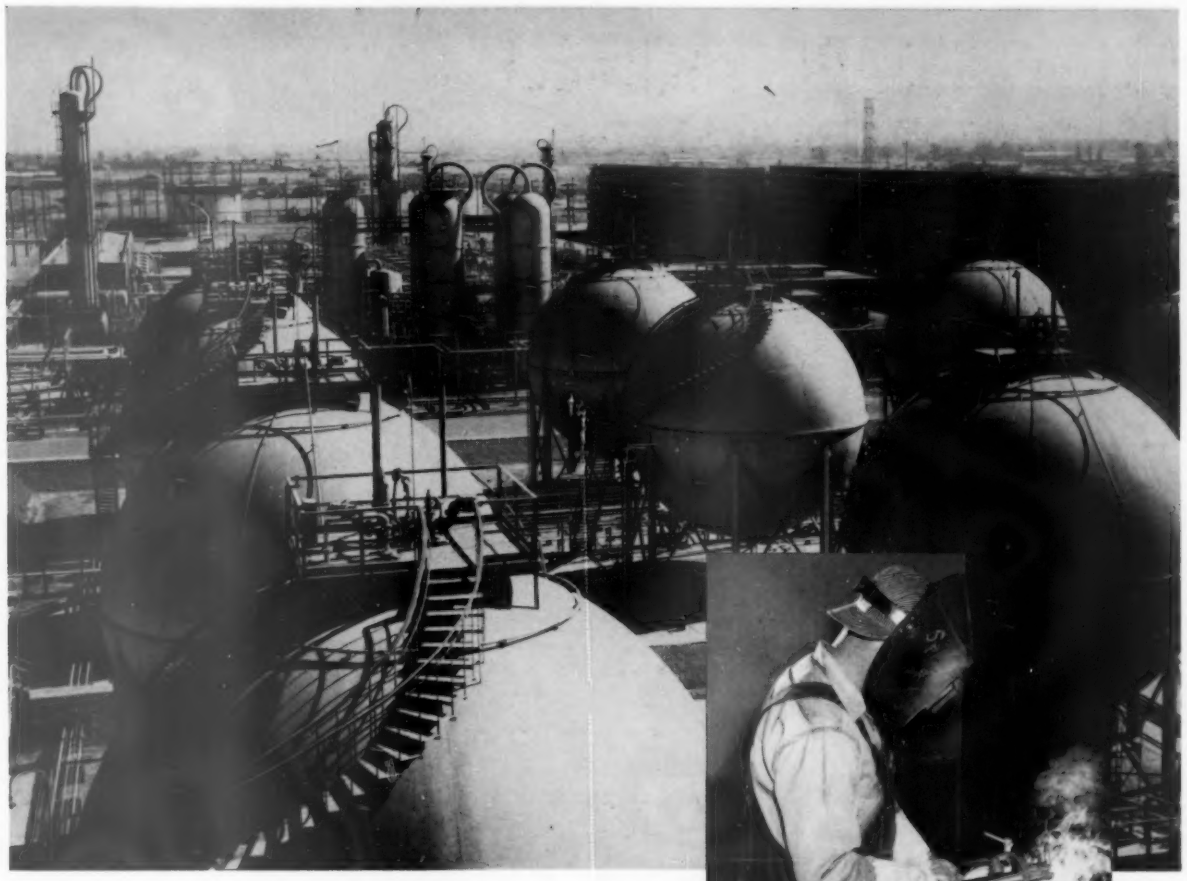

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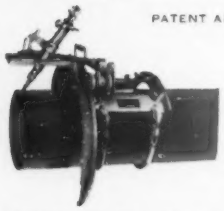

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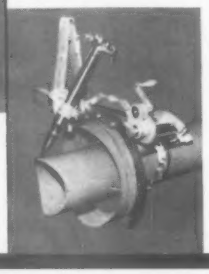

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